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THE COLLEGE SUGAR FACTORY.

THE completion of the model sugar factory of the Imperial College of Tropical Agriculture is an event of more than passing moment. Just as the formation of the Imperial Department of Agriculture for the West Indies marked a fundamental change in the attitude of the Imperial Government towards the Colonies, so the erection of the experimental sugar factory marks a new era in the attitude of the British people towards tropical problems. That far-sighted statesman Mr. Joseph Chamberlain, to whose initiative and energy the birth of the Imperial Department of Agriculture for the West Indies was due, and who was responsible for inaugurating that campaign of constructive Imperialism which characterises the latter end of the 19th century, would have rejoiced at the completion of this factory, which it is hoped will do as much for the advancement of the British sugar industry as the Imperial Department did for agriculture in the West Indies.

It must be confessed that, as in many other matters relating to the application of education to definite ends, America was first in the field, and astonishing claims are advanced on behalf of the Audubon Sugar School of the Louisiana State University. It is to be hoped that when the factory of the Imperial College can boast of the same ripe experience as her American sister, she will, with legitimate pride, be able to advance even more ambitious claims.

The factory will commence operations at a most opportune moment for, as we have already demonstrated in the pages of this Journal (*Trop. Agr.* Vol. II. No. 1, pp. 4 and 16), Britain is being forced to realise her unenviable dependence upon foreign supplies of sugar. There was a time at the beginning of the last century when the West Indies produced sufficient sugar to supply practically the whole requirements of the United Kingdom. Within a comparatively short period of time the phenomenal rise of the beet sugar industry on the Continent and the development of the cane sugar industry in other countries, almost wholly foreign, practically ousted the supplies of West Indian sugar from the Home market and this British source of sugar was forced to look elsewhere for markets. While sugar remains equally important to the West Indies as during the early days of the 19th century the output, relative to the world's supplies, has become almost insignificant. The enormous development in the world's production of sugar has rendered this commodity a common food in the diet of a large proportion of the population of the world, and while this is a matter of considerable satisfaction it is profoundly to be regretted that almost the whole of this development has occurred without the British Empire; so that the sugar markets of the world are to an ever increasing extent dominated by American interests. Without drawing any false inference from the establishment of the American Sugar School and the rise of the American domination in the cane sugar industry, it is to be hoped that the establishment of the sugar factory of the Imperial College of Tropical Agriculture will coincide with a strong revival in the British cane sugar industry. As we have already pointed out (*Trop. Agr.* Vol. II. No. 1. pp. 5 and 16) the

Empire can produce a supply of sugar entirely adequate to its needs and the Experimental Sugar Factory should form an adequate training ground for the future managers of British sugar factories.

The factory has been the source of a considerable amount of interest and has frequently been visited by the managers of British sugar estates and eminent sugar technologists who have admired the magnificent equipment. The results of the operations during the approaching season will be awaited with interest. At present three 3rd year students and one post-graduate, who are specialising in sugar technology, will be instructed in the management of the Factory. (For details as to the College Course in Sugar Technology the reader is referred to *Trop. Agr.* Vol. I. No. 9. pp. 131-32.) At a later date it is hoped that opportunities, by means of short courses, may be offered to those who have already had experience in commercial factory working in order that they may familiarise themselves with the most modern developments. British sugar factory managers have almost without exception been trained in the hard school of experience. There is no substitute for experience but as Sir Arthur Shipley, the Chairman of the Governing Body of the College, has ventured to affirm, "a young man trained at the College for three years, followed by a couple of years on a plantation will prove more efficient than one who has spent fifteen years on a plantation alone."

It should be emphasised that the sugar factory is no toy but a model factory working on a small commercial scale, with a comprehensive equipment of the very latest models of sugar machinery which give the factory considerable flexibility, so that, with very slight adaptation, the factory can be utilised to manufacture sugar by any known modern process. It thus presents the possibility of gaining experience in various processes which could never be learnt in a single commercial factory. The equipment of the factory is largely the result of a magnificent gift by British sugar machinery manufacturers, (details of these gifts and the equipment of the factory will be published in a supplement to the April number), for which generosity they can never be sufficiently thanked. Our success will be their success; our failure theirs.

The factory will be run on strict financial lines and the system of cost accounting to be adopted will enable the costs of production at every stage of manufacture to be obtained with accuracy. The success or failure of the factory should not be gauged, however, solely by the financial results, as the main purposes are instructional and experimental. It is in this respect that the College Sugar Factory possesses a considerable advantage over the ordinary estate factory which has usually to be worked at high pressure, owing to the limited crop period, making it impossible to adapt the machinery to conduct exhaustive experiments or to give instructional courses. The College factory has been carefully designed to meet these requirements and contains experimental apparatus which is lacking in the average commercial factory.

It has been urged, with a considerable amount of truth, that sugar is made in the field and not in the factory. In this respect the College is at present ill adapted for the training of students. During the present year the Trinidad Government Farm and the St. Augustine Experiment Station have arranged to supply the College with 2,000 tons of cane to meet the season's requirements. Experimental work in growing canes on a small scale is carried on at the College, and in the immediate neighbourhood are a number of large sugar estates whose proprietors and managers have generously afforded opportunities for the College Staff and students to study the production of cane upon a large scale. We are peculiarly fortunate in having these facilities but it is essential that the College should be able to offer equal facilities both for the production of cane and the manufacture of the sugar. For this purpose an estate of comprehensive dimensions is required to meet the demands not only of sugar cane but also the requirements of the various other crops for training in the cultivation of which the College hopes to offer special advantages. Nor is this all, for in time it is hoped that facilities similar to those existing for sugar technologists will be afforded to students desiring to specialise in the manufacture of other tropical agricultural products such as rubber, cacao, tea, fibres, &c.

The scope of the College is an ambitious one, as indeed it needs must be, to serve its Imperial purpose. The degree of success depends upon the measure of support afforded by the whole Empire, and in this respect it is peculiarly gratifying to note that in response to Lord Milner's Appeal for funds on behalf of the College, generous response is coming from widely scattered areas in the British Empire. The support afforded by Trinidad, by British sugar machinery manufacturers and by numerous individuals, has set an example which is rapidly being followed by other Colonies and individuals. Interest is at present centered around the result of the Appeal at the Mansion House on January 29th, when Mr. L. S. Amery, Colonial Secretary, Lord Burnham, who is temporarily "fathering" the appeal during the absence of Lord Milner in South Africa, and other eminent Statesmen spoke on behalf of the College.

The College possesses unrivalled facilities for the training of all whose future lies in tropical agriculture or administration and with the provision of adequate funds its future is assured. It is hoped that as with the Sugar Factory so with other branches of tropical agriculture, the Imperial College of Tropical Agriculture may be the first in the Empire.

LIVESTOCK.

Opportunities in the Tropics.

PROFESSOR J. SYDNEY DASH, B.S.A.

[*In this introductory article on "Livestock in the Tropics" Professor Dash deals with the general aspects of a highly important subject which hitherto, has not received the scientific attention it deserves. In subsequent issues of this Journal we hope to deal with the problem as it presents itself in different tropical countries, beginning with the "Cattle Industry in Southern Rhodesia."*]

IN a previous number of this Journal the writer undertook to show the need for more research work on livestock in the tropics, the nutrition aspect and costs being strongly emphasized. With tropical agriculture gradually assuming a more permanent nature, consequent on the spread of knowledge concerning disease and the increase of the European population in many places, greater attention in the future to the breeding and management of stock for specific purposes may confidently be expected. Particularly should this be the case in respect to cattle, with which this article exclusively deals, conditions lending themselves better to their raising in large numbers than perhaps other classes of livestock. In this connection, recent progress in Rhodesia—where good grazing land is abundant—in the development of a beef trade with the old country may be pointed to. Scarcely anything has been done, however, in educating people in the tropics as to the value of fresh milk as a food, and as a result, a large and steady demand for this product has still to be created. It may be a surprise to many of our readers to know that condensed milk is not infrequently retailed in some towns by the spoonful, and quite often the only sources of fresh milk available are individual cows of the scrub type belonging to an illiterate peasantry located a few miles away, from whom little can be expected in the way of hygienic measures to ensure the production of wholesome milk. As a consequence, there has sprung up a frantic competition between the purveyors of the numerous brands of imported tinned milks which decorate the shelves of tropical groceries.

It may be argued that climatic conditions in warm countries prevent the keeping of milk to ensure its reaching the consumer in a satisfactory condition, especially when and if produced on commercial lines some distance away from large populous centres. This difficulty is not insuperable when we consider the progress that has been made in methods of sterilizing, handling and distributing milk. Attention may here be called to the Jonas Nielsen milk pasteurizer and sterilizer, a Danish invention, particulars of which are given in a pamphlet by Mr. G. Sutherland Thompson, printed by Clare, Son & Co., Ltd., Wells, Somerset. This process enabled South African milk to be carried to England and served at Wembley without any noticeable change in its quality and flavour. A recent Chicago paper also announced the use of thermos tank cars operating on the principle of the thermos bottle for the preservation and transportation of milk from producer to consumer in good condition. Such inventions cannot but impress one as to the enormous possibilities in tropical dairying awaiting intelligent and energetic agriculturists. In many cases, those already engaged in some branch of farming may find it profitable to combine milk production and thus avoid having all their eggs in one basket.

The question of suitable cattle breeds has already received a great deal of attention and much has been accomplished as regards disease resistant types, notably for draft purposes, this being hitherto the main use to which cattle have been put. Attempts also to improve tropical breeds by crossing with northern have, in many instances, been attended with successful results for milk and beef production. The latter not being resistant to ticks and ailments tick borne, must, where these are prevalent, be infused with blood of the more hardy types or kept off ranges and pastures—only possible in a very limited way under an intensive system of feeding and management. Much uncertainty, however, in methods and practices exists, and there is a pressing need for the work so far done in this direction to be correlated before breeding policies for tropical requirements can take more definite shape. The time may, indeed, be ripe for a conference of livestock workers in the tropics with a view to discussing the progress made and plans for the future. The writer is tempted to suggest this course too because so little appears to be known generally about the origin and development of strains of tropical cattle, of which there must be a great number which have arisen in the course of years by natural selection or otherwise, and adapted to the varying conditions of climate and locality. In other words, tropical breeders have now before them the similar task of building up breeds and types which confronted their northern confreres many years ago from the material then available. That some of their problems are still unsolved may be judged from the reports of the Scottish Cattle Breeding Conference just held at Edinburgh, a comprehensive treatise on which is being prepared and is to be issued by Messrs. Oliver and Boyd. A small pamphlet has already appeared to comply with the demands of cattle breed societies. With these facts before us there is no need to stress further the importance of a similar conference to deal with livestock problems in the tropics.

When one thinks in terms of cattle in the tropical world, one immediately calls to mind the muscular humped or Zebu type, developed mainly on draft lines, and for which India is so justly famous. Their characteristics and qualities are too well known to require repetition here. Religious instincts have played no small part in the care and handling of these Indian cattle—the draft horses of

this great country—specimens of which are now found throughout the tropics and sub-tropics. It is pleasing to note that in recent years the Departments of Agriculture in India have done much in the improvement and selection of types suitable for milk, and reports on the yields of some of these are most encouraging, considering that the average Zebu female does not produce as much milk as a good goat. Zebu-Holstein crosses have also become popular as milking animals in some places ; at the same time, size of progeny for work purposes is in no way compromised by this cross. It now remains to be definitely ascertained within what limits such or similar practices may be carried on in order that the maximum amount of usefulness can be obtained without jeopardizing the good points of either parent. Animal genetics in the tropics provides a large field for the pains-taking investigator.

While India has been largely looked to in the past to supply breeding stock for the hardy types of cattle, religious and political conditions in that country may prevent these needs being met in the future ; in fact, it was stated some time ago that their export had been prohibited. How far this has been put into operation, the writer is not aware. Fortunately, in Africa, a relative of the Zebu exists in a high state of perfection as a breed, and Africander cattle as they are called should provide useful material on which to build tropical herds. Reference to this breed in the past has been scant, but at the hands of agricultural workers at the modern colleges and farms in the Union, progress in its development has been so rapid that 12 years ago an Africander Breeders' Association was formed and efforts made to standardize the type. Professor Bosman of the Transvaal University College, Pretoria, states that all the evidence so far examined goes to show that the Africander is an indigenous breed of cattle derived from the humped Asian species—*Bos indicus*, and not from European ancestry—*Bos taurus*. The Hottentot and Bantu tribes it seems herded cattle and at a very early date there was bartering between Hottentots and Boers. These Hottentot cattle it would appear are the progenitors of this race. The breed was nearly exterminated in the South African war but has been firmly re-established from the remnants of the great herds that were in existence at that time. This fact is taken as an indication of the prepotency and ancient lineage of the breed. The colour is red, varying from light to dark, but cattle with yellow and white markings may be seen ; one of the objects of the Association is to fix a solid red colour in its various shades for the breed. In general type, they are not very unlike Indian cattle, but the hump is much less marked. Selection and environment have opreated in the development of the Africander which was important in the first place as a trek ox—active, intelligent, powerful and hardy—suitable for all forms of transport. The characteristics are given in some detail in the *Journal of the Department of Agriculture* of the Union of South Africa for June, 1924, and readers who are interested in the breed should communicate with the Secretary, Africander Breeders' Society, Box 377, Bloemfontein.

The breed is particularly adapted to the heavily tick-infested parts of South Africa and is widely distributed in the Northern Transvaal, Natal and Rhodesia ; indeed, their adaptability to varying conditions of tropical environment, particularly as regards forage, seems remarkable. Unexcelled for constitutional vigour, this breed is also noted for great longevity and fecundity. Oxen may attain a body weight of approximately 1,250 lb. at six years, while mature bulls may run over 2,000 lb. They are said to be very docile. As a beef animal, the Africander has acquired a good reputation in its native home and feeding experiments have shown that a satisfactory percentage of dressed carcass can be obtained. Their value as foundation stock for crossing with such breeds as Shorthorn, Angus, Hereford, Sussex and Devon for beef production on a large scale, where early maturity is a factor to be considered, would seem to have been definitely established, thanks to the persistence and zealousness of the workers engaged in studying the question in South Africa. From this standpoint, the developments in Rhodesia already referred to will be watched with the greatest interest. As a milking animal, the Africander appears to have been neglected, but cows yielding 3½ gallons of milk per day can be found in the most pure-bred herds. Like its relative the Zebu, it is difficult to obtain milk from the cows without the presence of the calf. As, however, the breed responds well to selection, its future in the livestock economics of tropical and sub-tropical regions seems now assured.

In conclusion, we think enough has been said to show that the livestock situation in the tropics is pregnant with opportunities no less for the commercial man than for the student. The possibility of finding new types, hardy and vigorous, which will respond to methods of improvement, suggests a fascinating line of investigation, and in this connection the water buffalo—which from work already in progress gives evidence of being amenable to improvement—should not be excluded. There is need, however, to bring together all the scattered information which has so far been obtained, to reject that which is worthless and to place the work on a broad, scientific basis, taking care to profit by the experience of the breeder in temperate regions and to avoid his mistakes. As already pointed out, a conference would do much to clear the atmosphere and open the way to still further progress. The aim should be not to encourage fads in breeding, even though it may be possible to produce a few £5,000 animals (price recently paid for a Guernsey cow in the United States), but so to stabilize the livestock business that the greatest profit may result to the greatest number of those who are looking to the tropics for a living, and whose aggregate is steadily increasing.

GOVERNMENT BOTANIC GARDENS.

By Lieut.-Colonel Sir David Prain, C.M.G., C.I.E., LL.D., F.L.S., F.R.S., late Director of Royal Botanic Gardens, Kew.

[*The following is the substance of the first part of the Sir George Birdwood Memorial Lecture delivered before the Royal Society of Arts (Indian Section) by Sir David Prain. The article will be concluded in our next issue.*]

An invitation to deliver a Sir George Birdwood Memorial Lecture comes as an especial honour to one who has been indebted to Sir George for help in connection with economic enquiries in their historical aspect. Yet the acceptance of that invitation by one who has had occasion to investigate further questions already illuminated by Sir George's touch has involved responsibilities he would have found it more difficult to undertake, had not the Committee of the Indian Section of the Royal Society of Arts, with a kindness for which he has to thank them, prescribed the subject to be discussed.

Sir George's comments on Garcia show that the work of Botanic Gardens interested him, and suggest that he regarded it primarily from an historian's standpoint. Though it be impossible now, to treat the theme with all Sir George's erudition it is desirable to approach it in Sir George's spirit. To an audience like this Sir George might have illustrated from Indian experience the purposes Government Botanic Gardens fulfil, though he would have had to refer, in passing, to Botanic Gardens other than Indian. All botanic gardens depend for success in their undertakings on their capacity to enlist the sympathetic co-operation of cognate organisations. But when explaining what a botanic garden is, Sir George could not have confined his references to Indian examples. Notwithstanding the uniformity of purpose which enables botanic gardens to render each other effective service, these institutions cannot claim a corresponding uniformity of origin. The Government Botanic Gardens of Asia, in particular, owe their formation to motives rather different from the reasons that have led to the existence of most of the Botanic Gardens of Europe.

Many who take pleasure in visits to Botanic Gardens express their inability to discriminate between an establishment of this kind and a public park. Some who derive benefit from such visits seem to imagine that a botanic garden must subserve a horticultural purpose. Botanic gardens do occasionally possess amenities that render them places of popular resort; they often supply information that gardeners are glad to secure. Yet, however natural these somewhat discordant ideas may seem, they overlook the fact that a botanic garden exists to further botanical ends.

Botanical ends have been modified oftener than once since the Greek term "botanicey" first came to indicate, in English letters, the science of "knowing plants," and was used in order to contrast the study of plant-characters with "phytology" which, even after the middle of the XVIIth century, still was "the art of ascertaining the temperatures, virtues and uses of plants, as tending to the curation or sustentation of the body." This particular definition was written at Oxford and was published in 1659. It is desirable to note the place and the date. A generation before this definition was formulated, the University of Oxford had been supplied with a chair for the teaching of "botanicey:" that University had to wait till a decade after this definition was published before it found a "professor of botanicey"—the first of the kind in England—to fill that chair.

Phytologists, intent on the study of plant-qualities, had been conscious, since the middle of the XVIth century, of the pressing need for a further knowledge of plant-characters. The doubling of the Cape and the discovery of the Western Hemisphere had resulted in an almost overwhelming influx of new material; "phytologists" were no longer able to discriminate, by classical or mediaeval criteria, between plants whose products were useful and others whose products were valueless or might be harmful.

This renaissance co-partnery between "botanicey" and "phytology" subsisted so long as the study of plant-structure and plant-function lay outside the domain of "natural history." Their alliance was so close that the science of "botanicey"—now "botany" for short—came to be looked upon as the basis of, rather than as an adjunct to, the "art of phytology." In 1663 those who in this country laid down the rules that should guide the conduct of seekers after scientific truth made it an axiom that the improvement of new natural knowledge for use should go hand in hand with its improvement for further discovery. By the middle of the XVIIIth century "botanists" had come to realise the importance of plant-function on the reproductive side, and to believe that a solution of the "mystery of sex" might enable them better to classify the vegetable kingdom and to elucidate the natural history of plants. They could now study plants philosophically: "plant-distribution" and "plant-association" came to receive as much attention as "plant-characters" and "plant-qualities." This of necessity made the "botanist" also a "phytologist"—a modification wholly beneficial. Unfortunately, however, the "phytologist" of 1750, the year in which this wider philosophy of plant-study was first formulated, did not require to profess mastery of the science of "botany"; the application of the natural knowledge of plants, which was the "phytologist's" duty, was still considered an "art."

The earlier half of the XIXth century brought further changes. The study of "vegetable statics," hitherto a branch of "natural philosophy," was found to belong to biology as well as to physics; anatomy demonstrated the existence, chemistry tried to explain the purpose of the "cell." Intensive study of the plant as a vital mechanism

appeared to be possible without an extensive knowledge of plants as living organisms; by a process of reasoning familiar in other connections, students of "plant-structure" and of "plant-function on the nutritive side" came to regard themselves as the people with whom wisdom must die. They arrogated to themselves the designation "botanist"; students of plant-characters and plant-qualities, of plant-distribution and plant-association were, at best, only "natural historians." A new century has seen further modifications. The study of plant-function on the nutritive side, whether under those normal conditions that we term physiological or those abnormal ones which we regard as pathological, has made it clear that growth depends on factors other than the nature of the substratum. Plant-association now possesses a biological significance so profound that students of oecology seem at times disposed to relegate "morphology" to the position that laboratory-research in the XIXth century deemed appropriate to cabinet-investigation. On the other hand, the study of the "mystery of sex," renewed in the XIXth century with a vigour induced by the mastery of experimental method, has been extended with success into realms undreamt of in the XVIIIth century. As a result the study of the characters and qualities of plants has acquired a new importance, both for those engaged in the botanic garden or the field in handling old and in raising new plants, and for those busy in the herbarium or the museum in supplying the systematic and synoptic data without which natural knowledge cannot be applied so fully as it should. The tendency, displayed in the XVIIIth century and insisted on in the XIXth, to regard the application of natural knowledge as a matter which concerns only the arts and crafts interested, has for the time being disappeared. Now, even more definitely than in 1750, botany is the branch of natural science whose business is the study of vegetation in all its aspects.

These changes in the scope of plant-study have affected workers in botanic gardens as greatly as they have affected those whose investigations are conducted in the field, the cabinet or the laboratory. In spite of this it sometimes appears, to those unfamiliar with what botanic gardens do, that there has been less modification in botanic garden methods than in laboratory or cabinet-practice. Appearances are at times misleading; the misapprehension in this case is one of the consequences of incomplete observation. Workers in a botanic garden are subject to influences that hardly affect those privileged to labour in the field, the cabinet, or the laboratory. The field-botanist is free to confine his attention to the philosophy of plant-distribution or to that of plant-association, as he may decide. The cabinet-worker may devote his energies to the study of the characters, or the qualities, or both, of a single natural group of living organisms; the laboratory-student may concentrate his attention on the solution of definite morphological or physiological problems. But the garden-worker who deals with taxonomic problems has to use them as means to practical ends. The botanic garden-worker realises that the somewhat arrogant XIXth century distinction between "scientific" and "systematic" botany is only a rather ungracious variant of the more refined XVIIIth century objection to "botany"—the science of "knowing plants"—as an occupation which "amuses the fancy and exercises the memory without improving the mind or adding to real knowledge." The botanic garden-worker is aware that when, in the field or the cabinet, "system" is treated as an end in itself, this objection may be valid. But the botanic-garden-worker, being a "phytologist" as well as a "botanist," knows that without system it is not possible to carry out that part of his duty which involves the making of natural knowledge available to industry and commerce.

Towards the results of laboratory-research the attitude of the botanic garden resembles that maintained towards cabinet-study. When applying the physiological knowledge gained by the laboratory worker, whether in relation to health or disease, and whether on the nutritive or the reproductive side, the worker in a botanic garden remains interested in the morphological bearings of his investigation, and makes himself as conversant with the characters and qualities of the plants employed as if he were an herbarium—or a museum—student.

To this freedom to concentrate attention on particular problems or particular aspects of problems the success of work in the laboratory, the cabinet and the field is often due. But if the necessity to retain old as well as to adopt and apply new methods, which work in a botanic garden involves, may at times seem to possess certain extrinsic drawbacks, it has also some intrinsic advantages. It permits, among other things, a continuity of interest and effort that need not be limited to the lifetime of the individual worker, and need not disappear with the dominance of a particular phase of botanical thought.

One influence to which this continuity is to some extent due, is that exercised on botany by garden craft, whose aid is essential to the management of a botanic garden. It is this feature which explains the idea that a botanic garden must serve the purposes of horticulture. Yet it is this feature which enables us, on further thought, to realise that this idea, so often entertained, must be the converse of reality. There is, no doubt, in any botanic garden an intimate alliance between botany and gardencraft. But a botanic garden is not, on that account, an institution in which botany professes to demonstrate how plants should be grown; it is a place where gardencraft assists botany to increase natural knowledge.

The tendency to confuse a botanic garden with a public park is more intimately connected with our modern and popular conception of "a garden." We are apt to forget that this term, shorn of accidental associations, means no more than an enclosure which shelters cultivated plants. We

are tempted to think of a "garden" as did that great Lord Chancellor who remarked with truth, three hundred years ago, that "to garden finely" was a perfection "reserved for ages grown to civility and elegancie." The "garden" Bacon had in mind is an enclosure which, while affording protection to the plants contained, promises its owner and his friends intellectual pleasure and artistic satisfaction. So remote is this conception from the original one, yet so widely does it prevail, that when national needs, begotten of war conditions, called for a reversion to primitive practice, a new name had to be found for an old thing. The "allotment," which reiterates the uncivil and inelegant precept that man must eat his bread in the sweat of his face, reminds us that the original purpose of the "garden-close" was severely economic; that it was meant to provide for man's bodily welfare, without making any offer of mental refreshment or any appeal to aesthetic feeling. Those familiar with tropical conditions recognise in the "allotment" a return, dictated by necessity, to that undifferentiated husbandry characteristic of hot countries with a maritime or a monsoon climate, where the plough has not yet supplanted the hoe.

In one respect the "allotment," though possibly more perfect, is perhaps less complete than the tilled enclosure in which no distinction can be drawn between the "field" and the "yard." The primitive enclosure served a double purpose: it ministered to the sound by providing much of what the husbandman could eat and some portion of what he might wear; it tried to serve the sick by supplying what, it was thought, could mitigate pain and what, it was hoped, might cure disease. The disappearance of domestic remedies from modern enclosures is not, however, a direct result of the pre-historic specialisation which led to the evolution of the "medicine-man," who found his prestige enhanced when he could supplement and in time replace the familiar "simples" of his tribe by drugs collected afield and in secret, under favourable planetary conjunctions and during suitable phases of the moon. Our neglect of these plants is perhaps more immediately traceable to that modification of outlook which led many of the northern races of Europe to regard with some suspicion matters in any way connected with the Church of Rome.

The Latins, whose interests were largely economic and whose curiosity did not always extend beyond the practical, classified the plants they cultivated or put to economic use in accordance with their qualities. This grouping was accepted by renaissance students, and, among the groups thus recognised, those that chiefly concern us now were the "esculent," the "medicinal," the "coronary," the "aromatic." The group of "medicinal plants" included the sources of mediaeval domestic remedies—plants rarely grown in modern northern gardens. They were, perhaps, hardly more familiar in classical gardens than in ours. Though medicinal plants are discussed by authors like Dioscorides and Pliny, the exploitation of the drugs they yielded was largely left, in classical days, to specialists who were often accused of witchcraft and sometimes suspected of murder. In this connection the advent of a Levantine faith, whose influence grew as that of classical "civility and elegancie" decayed, did rather more than banish dark beliefs which cultured paganism was content to entertain. If the laity in the middle ages showed a disposition to abide by this pagan habit, the early church set its face against it and reverted to the practice of growing homely remedies. The original undifferentiated "tilled enclosure" had harboured, along with the rudiments of horticulture and of agriculture, also the germ of medicine, and thereby inspired the formation of the "herbularies" that, in the oldest of monastic establishments, found a place alongside the plots in which the brethren grew their legumes and their fruits. By a simple and easy transition the monastic "herbulary" developed into the "physic garden" characteristic of the medical schools attached to the Universities that sprang up so freely after the fall of Byzantium and the consequent revival of learning in Western Europe.

It is sometimes believed that because, by an equally easy transition, such a "physic garden" could develop into a botanic garden, there may be some essential connection between "medicine" and "botany." While it is true that some five botanic gardens in Europe out of six began as "physic gardens," the connection between "botany" and "medicine" was really accidental. The cultivation of "esculent plants" was attended to as carefully in monastic gardens as was that of "medicinal plants." If the cultivation of "herbs of healing" was due to a conscious ecclesiastical effort to place the use of drugs on a higher plane than in pagan days, the cultivation of food-plants was an equally conscious endeavour to preserve something worth saving from the wreck of the Western Empire. In the "physic gardens" to which these monastic "herbularies" gave rise, there was the same combined practical cultivation and phytological study of vegetables and drugs; the same equal attention to the maintenance of health and the treatment of disease. The urgency of the need for botanical aid, in which renaissance "phytology" stood, was less in connection with new drugs than in connection with new foods and food-accessories, like the potato, the topinambour, cocoa, tea, tobacco and so many more, then for the first time finding their way to Europe.

This alliance of the mediaeval art of "phytology" with the renaissance science of "botanicey" was really a reversion to an attitude manifested in Greece some eighteen centuries earlier. The garden formed by Aristotle, in which his pupil Theophrastus discoursed περὶ φυτῶν, was nearer in purpose to a modern botanic garden than any "physic garden" of the XVIth century. This explains Rousseau's remark that Theophrastus was the only "botanist" the ancient world produced. Theophrastus, alone among classical writers, dealt with plants as living things rather than as sources

of useful products. What we learn of his doctrine shows that he was inspired by "scientific curiosity." His teaching was as philosophical in spirit as the teaching of botany is to-day. If, since the middle of the XVIIth century the "botanist" has been also a "phytologist," we have to admit that in the days of peripatetic philosophy the "phytologist" was what the "botanist" is in the XXth century.

Some of the plants used by Theophrastus to illustrate botanical facts show that this garden contained "coronary" as well as "esculent" and "medicinal" plants. This does not imply, however, that his enclosure was a "garden" in the renaissance sense. The Greeks and Latins could garden well; they had mastered the art of making domesticated plants thrive. They grew in their enclosures many "coronary" plants for their intrinsic beauty or for their scent. But the intellectual pleasure these "herbs of grace" afforded was tempered by their suitability for the making of wreaths. The classical householder did not "garden finely," he made no conscious effort to dispose the "coronary" plants he cultivated so as to produce a pleasing general effect. Nor did mediaeval monastic enclosures do more in this direction. A faith that strove to wean the thoughts of believers from this imperfect world paid but little attention to what the unconverted considered "herbs of grace." It did, indeed, condone the cultivation of some "coronary plants," not because of their "grace," but owing to their association with legends concerning Our Lady and with traditions as to the lives and deaths of saints and martyrs. The impulse that, in renaissance days, led men and women of means and taste "to garden finely" was not identical with the incentive to form "physic gardens." The formation of enclosures to afford intellectual pleasure and satisfy artistic desires was an amplification of the classical regard for "coronary" plants rather than a development of monastic practice. That amplification was due to the use of classical "herbs of grace and faith" in attempts to reproduce those Oriental "paradises" whose existence was attested in works that were canonical and whose nature could be gleaned from accounts of Arab culture.

When the makers of renaissance "pleasaunces" happened to be imbued with "scientific curiosity" as well as with "artistic skill," such establishments became at once as truly botanic gardens as any of those that had originally been "physic gardens." The renown, in their day, of gardens like that of John Brancion in Flanders, that of Cardinal Farnese at Rome, that which the Burgomaster of Terneuzen put at the disposal of Pastor Peter Hondius, that of John Goodyer in Hampshire—to mention but a few private establishments which chanced to be almost contemporary—was at least equal to that of the gardens attached to Universities like those of Padua, Pisa or Leiden; those of Paris, Montpellier or Oxford. Though the "physic gardens" attached to Universities have so often continued to exist as Botanic Gardens, while the private "pleasaunces" that were botanic gardens from the time they were formed rarely managed to survive, the difference in their fates was due to the character of their ownership rather than to the nature of their origin. Two instances from English botanical history may suffice to explain the situation. The private garden of John Gerard, herbalist of Holborn, one of the best known "physic gardens" in this country at the close of the XVIth century, ceased to exist after its owner's death. On the other hand, an XVIIIth century English "pleasure garden," which owed its origin to the artistic instinct, and its conversion into a botanic garden to the scientific curiosity of an enlightened Princess, enjoys still a renown wider than that of any other botanic garden in the Empire, and is regarded by strangers as second to no botanic garden in the world.

The absence of allusions to other classical gardens in which plants were grown to gratify the "scientific curiosity" of those who visited them, suggests that the idea underlying the formation of the one in which Theophrastus lectured may have been peculiar to Aristotle. Egypt had at least one garden which combined to some extent the features of a "physic garden" and a "pleasaunce." Babylon, it appears, had its "paradise." The medical writings of India and Assyria suggest that they may have had "physic gardens." But it is difficult to suggest an exotic source for Aristotle's inspiration, and we are only prevented from feeling assured that it originated with him because the same conception happened to take concrete form in the Western Hemisphere. When Europeans reached America, Mexico could boast the possession of two botanic gardens, designed to satisfy both the economic and the scientific curiosity of Montezuma's subjects. Spain, after her conquest of that kingdom, did what she could to maintain and preserve one of these gardens.

(To be concluded.)

IMPERIAL FORESTRY INSTITUTE.

THE Imperial Forestry Institute at Oxford started work on October 13, 1924, temporary accommodation having been provided in the School of Forestry building until arrangements can be completed for the erection of new buildings on another site. The Board of Governors of the Institute is now fully constituted with Lord Clinton, Forestry Commissioner as Chairman.

Professor R. S. Troup, C.I.E., M.A., D.SC., has been appointed Director. In addition to its own staff the Institute will have the assistance of several of the members of the Staff of the School of Forestry. The Forestry Commissioners have agreed to station at the Institute certain of their research officers. In spite of the fact that the Institute is not yet fully organized and that sufficient time has not yet elapsed for the attendance of students from all parts of the Empire, nine students, deputed by the Colonial Office and the Forestry Commissioners, have begun special courses, and further students are expected to join during the next few months.

TROPICAL AGRICULTURE.

Development in the West Indies.

SIR ARTHUR SHIPLEY, G.B.E., D.SC., F.R.S.

[*The following article is the substance of an address delivered by Sir Arthur Shipley, Chairman of the Governing Body of the College, to members of the Royal Colonial Institute.*]

A large proportion of the King's Dominions beyond the seas lies between the Tropics of Cancer and Capricorn. Almost half Australia, about one-third of India and of Burma, vast tracts of Africa, British Guiana, and innumerable islands in the East and West Indies and in the Pacific Ocean are tropical, and still larger portions of the Empire are sub-tropical. The cultivation of these great and fertile lands has hitherto been empirical rather than scientific. The young planter or farmer picked up what knowledge he acquired from an older planter or farmer. With the view of changing this the British authorities have initiated an entirely new movement, and by the establishment of the Imperial College of Tropical Agriculture, at Trinidad, they are providing for the agriculturists of the warmer regions of the Globe, not only in the West Indies, but in all the tropical areas of the Empire and, indeed, outside the Empire, a sound, modern and scientific training. The subject is so vast that I must neglect altogether many of its aspects. I have nothing to say about chemistry, physics, classification of plants, horticulture, soil, or economics. I shall speak only on the subject of plant disease and what causes disease, and how in many cases disease can be controlled, though in few cases cured.

The great number of the diseases which afflict plants are caused by three agencies. They are: (1) insects which eat them up, puncture and wound their tissues and in many cases introduce fungi—bacteria, moulds and mildew—into the body of the plant. (2) Fungi. These are by no means only conveyed by insects; their spores or seeds are blown about by the wind and enter any wounded or bruised part of the plant. They exist in incredible numbers in the soil, and push and burrow into the roots. Once inside the plant they multiply exceedingly, destroy the cells which build up the plant, choke the vessels which convey the sap to the leaves, block the air passages, so that the plant cannot breathe. (3) The third agency is round-worms. These are minute worms, often only $\frac{1}{25}$ inch in length, and invisible to the naked eye. They burrow from the soil into the plant and form galls or tumours. These are the different agents which, in the main, cause plant diseases. Now, how are we to check the enemies of plants and lay them low? One way is to render the plant strong and healthy so that its power of resistance is increased and it succumbs less readily to attack. This means very careful and clean farming and ceaseless care. Another method is to enforce a strict quarantine, and this is increasingly being done all over the world. It is more difficult to get a plant than it is to get a case of whisky into the United States. Such a quarantine is most easily enforced in an island such as Fiji. There, the sugar plantations are almost controlled by one great company, who have cleared their crops of fungi and bring effective force to bear on the smaller planters to use only fungus-free cuttings. Another way is to select and breed from races which are disease resisting. Such selection may be successful or may fail, at any rate it is rather speculative unless you follow the lines laid down by Mendel, and then it is sure. By following these lines Biffen, at Cambridge, has produced a rust-resisting wheat which breeds pure and has eliminated a loss of some 28 per cent., but this takes infinite patience. Consider the black rust of wheat which lives part of the time on the barberry. In 1903, after Rostrup had shown that the annual loss to Danish agriculture from black rust amounted to Kr. 10,000,000, the Law of 1869 for the extermination of the barberry was put into effect, and since that time the disease has been completely controlled. In South-West Wales, the only part of Britain where the barberry occurs extensively, the disease caused a loss of 50 per cent. of the crop in many fields in 1919. In the United States at the present time a big campaign is being carried out for the control of the disease, which causes losses amounting to millions of dollars annually. There are many other cases, all showing we are gradually being enabled to control disease. Leaf-curl of potatoes in England is said in some places to reduce the crop by as much as 64 per cent. Previously, losses from this disease were put down to degeneration, but scientific investigation has led to more accurate views of its nature, and a method of control has been applied which adequately controls the disease. By this means immense sums are saved annually. Insect pests may also be brought under control. They may be poisoned directly, and so great is the present demand for arsenic to poison the cotton boll weevil and the boll worm in the Southern States that it has paid to re-open the Cornish tin mines, closed down after the War, for the sake of the by-product arsenic, and this metal is now fetching an almost unprecedented price.

I have touched only the fringe of an enormous subject, and that subject is by no means one of the most important of the many subjects which are included in the science of agriculture. My object is to make clear that men of science are slowly, but surely, gaining some sort of control over the devastating forces of nature. Their work is laborious and never ending. Their failures, but for the fact that even failures teach us something, would be heart-breaking. Their material reward is almost always negligible, yet faith upholds them. But to train them for the contest they must have education, they must be taught what advances have been made by their predecessors, and are being made by their contemporaries, otherwise they would set out to discover what is already known and their labour would be in vain. Above all, they must learn to observe accurately and to record faithfully what they have observed.

They must look nature squarely in the face. The observer must make many experiments, and always he has to devise new ones. He must master a difficult technique if he is to work out the life history of the various enemies of plants. And this must be done in order to discover the weak point, the stage of the life-cycle of the enemy, when and where his attack is most likely to succeed. The training cannot be carried out at home and alone. It needs some such institution as that just established in Trinidad, with its library and laboratory and, above all, with its staff of expert Professors—"men furnished with ability." So far I have dwelt only on the training of the specialist, but the Imperial College has another and a most important function to perform, and that is educational. Its object is "to provide training in the science and practice of tropical agriculture to students intending to become tropical planters, agricultural administrators, or officers; or specialists in different branches of agricultural science and technology, and to offer facilities for the study of tropical agriculture to graduates of other Colleges and Universities. An important feature of the College is the provision for research and investigation work which its laboratories and fields afford." It is essentially an educational as well as a research institution, and in both directions it has made a good start. It was opened in October, 1922 with an efficient staff and 15 pupils, several from England. The temporary building has been replaced at the cost of some £40,000 by a permanent building, which owes much of its dignity to its fine and stately proportions. The building is equipped with all modern scientific appliances and is, in all respects, worthy of the Empire it seeks to serve. The placing of the College in the island of Trinidad has given rise to a little comment, but "after all," as Lord Milner said, "it had to be somewhere." Trinidad is the second largest island in the Antilles; its soil is not only fertile but is very varied; on it, large crops of every kind of tropical produce are grown, and—an important matter—it is free from hurricanes. Another factor played a part in the choice of the island for the new experiment, and that was the generous offer of a very considerable subsidy to the College by the Legislature of Trinidad and Tobago, and a very favourable site for the new College building. The financing of the new College has been a matter of anxiety to the promoters. The Imperial Government has contributed a grant of £15,000 to be spread over a period of five years. This will cease in 1927. The Colonies of Trinidad and Tobago, Barbados, the Windward Islands, and the Leeward Islands have generously granted subsidies of one-half of 1 per cent. of their average revenue of the last three preceding years. Handsome contributions have also been given by Mr. J. W. Stephens, of Trinidad, Messrs. Cadbury and Fry, the British Cotton Growing Association and others. Fees are purposely kept low.

After showing some slides on the screen, the lecturer continued: When Froude visited the West Indies, 35 years ago, he took a most melancholy views of things. He even predicted the collapse in the islands of European civilisation and its replacement by that of our African brothers. But things are not so bad as all that. Froude met one or two Americans who foresaw that there was money in the fruit of the islands, if properly marketed; but he could not have possibly foreseen the tremendous present development of the fruit industry, largely fostered by the United Fruit Company and supported, as far as Jamaica is concerned, by the Atlantic Fruit Company. The first is practically an American concern and the latter is probably financed by dollars. Nearly every day in the week one of their steamers leaves Kingston, in Jamaica, for some port of the Southern and Eastern seaboard of the United States laden with bananas; and the industry has now assumed such enormous proportions that no fewer than 16,000,000 bunches have been exported from this island in one year. Like so many others, this industry was started by an Englishman, the late Captain Baker, but Americans made it the enormous business it is. To a great extent they also control the banana market in British Honduras, in Panama, in Colombia and in Costa Rica. From the last-named Republic there are fortnightly sailings of steamers for Avonmouth which each carry some 80,000 bunches to England, with an average of about 140 bananas to a bunch. No fewer than 20 vessels are engaged in bringing this fruit from Jamaica and Central and South America as fast as they can carry them to our Ports. The immense development of the trade conducted by the Americans has given them a strong interest and a firm footing in many of the islands and on the Spanish Main. America has a powerful interest in sugar production and Cuba produces annually nearly 4,000,000 tons of sugar, whereas the whole of the rest of the West Indies and British Guiana together produce hardly one-sixteenth of this amount.

As one travels about the West Indies or calls at the Ports of Central America one is apt to notice that the American flag, or small reproductions of it, are flown by all the drivers of the little cabs or the motor-cabs that ply for hire. The American seems happier, or perhaps feels safer, if he has the Stars and Stripes sticking up ahead of him, or, at any rate, the natives think he feels like this. The "Hotel Americana" is much more common than the hotel of any nation. According to some housewives, the American is more ready to adapt his machines to their requirements than is the Britisher. This, undoubtedly, seems to be the case with the tractors which are now coming so largely to be used on the bigger estates in the West Indies and in British Guiana. There is something rather devastating about American culture. It produces a perfectly dead level and seems to flatten out things as the culture of no other country does. Places that Americans frequent, like the Bahamas and the Bermudas, seem compelled to have

American hotels and bars providing nothing but American drinks. Their motor-cars are, of course, everywhere.

Thanks to the munificence of Mr. J. D. Rockefeller and the public-spirited administration of the Rockefeller foundation, America is doing an immense work throughout the world in the way of preventive medicine, clearing up and eliminating disease. In the new world Americans are wrestling with yellow fever, and all round the world with another terrible disorder which attacks dwellers in the warmer parts of our globe—the hook or tunnel-worm disease. Instead of being everywhere, yellow fever is now isolated to two spots, and for all I know has now been eradicated. It was owing to Sir Ronald Ross's discovery that America, using his methods for dealing with malaria, was able to build the Panama Canal. Again, America has tackled the problem of hook-worm disease, which has, like malaria, a most debilitating effect upon all who suffer from it.

The work, both commercial and scientific, to which I have referred has naturally produced a great orientation towards the United States. People are grateful for what has been done. Some people have suggested that we should give up the West Indies to America as part of the war indemnity, but when one considers how little the United States paid for the Danish Islands, one realizes what they are likely to give for the West Indies. The United States are good at a bargain, and the few millions we might possibly get from them would not go far to cancel the "billions of principal and billions of interest" that are sometimes referred to. As I have said, all these trusts and interests in the West Indies have produced a certain orientation towards the United States. But the West Indies are intensely loyal, and I feel confident that there is nothing West Indians would resent more than being called upon to change the extremely wise and sane rule they enjoy under the British flag for any other liberty that existed on the globe.

THE Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly will communicate with him at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, B.W.I., when the matter will be rectified.

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture*, post free to anyone interested in tropical agriculture on application to him at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, British West Indies.

The Editor regrets that a number of subscribers who have asked for copies of numbers 1, 7 and 9 have been disappointed. A list is being kept and is being dealt with in strict rotation as copies of these numbers are returned.

COFFEE IN COSTA RICA.

THE *Revue de Botanique Appliquée* furnishes some interesting information concerning this republic which is one of the most suitable for coffee growing. The plantations are spread over three regions :—the central plateau, the Atlantic coast and the Pacific zone.

The central plateau slopes gently towards the Pacific and carries nine-tenths of the population. The plantations begin beyond the old town of Cartago, at an elevation of 1,500 m ; are especially successful around the towns of San José, the capital, and Heredia, both 1,500 m. above sea level, and spread down to the town of Alajuela (800 m. above sea level). These plantations, which have been in existence for over a century, produce the best coffee. This region has remarkable natural qualities and is in consequence over-populated. The climate is uniform and mild ; in San Jose it varies between 20° C. and 25° C. The rainfall is regular : the rainy season begins in May and finishes in December, with, usually, a short dry spell from June 15 to July 15. The dry season follows gradually with some wet weather in March and April which plays an important part in the flowering of the plant. The rivers have an abundant supply of water even after five months of drought ; the lands, of volcanic origin, are fertile ; the labour is sufficient and well trained to this kind of work and there are a number of small proprietors. The result of this is that the land is sold at very high prices and the cultivation is intensive.

The Atlantic slope has been industriously cultivated only during the last 25 years and consists entirely of big estates. Labour is scarce and the climate differs from that of the Central Plateau, the dry season being neither as long nor as marked. The coffee in this region is not of as good quality as that of the Central Plateau but the crop is earlier and for this reason obtains high prices on the markets. The plantations are in terraces between 800 and 500 feet, above sea level.

Buyers of Costa Rican coffee recognise three types :—Central Plateau, Atlantic slope and Pacific coast. The product of the country is thus uniform. In Guatemala there are not less than fourteen distinct types. The Atlantic coast coffee is remarkable for the size of seed and its beautiful blue green colour. It is not very hard and when roasted can be crushed between the fingers nor has it a very strong aroma. The Pacific coast coffee is a small, hard seed, of yellowish colour and good aroma. Central Plateau coffee is a type between the two. The seed is hard and big, of a fine colour and strong aroma, and the higher the plantation, and the more moist the climate, the larger is the seed.

Plantations at very high levels and with a dry climate produce as large seeds as plantations situated at lower levels but having more moisture; and the coffee obtained in the first case has more essence and more of the taste peculiar to Costa Rican coffee.

THE TROPICAL WORLD.

Southern Rhodesia.

In the *Rhodesian Agricultural Journal* Vol. XXI No. 6., Mr. D. D. Brown, Assistant Tobacco and Cotton Expert, gives an interesting review of the Southern Rhodesia Cotton Crop during the Season 1923-24.

He states that last year saw a sudden and increased interest taken in cotton, due to the report of favourable prices being obtained for American Upland on the English market. The farmers of Rhodesia have also felt the need, in many cases, of some addition to the number of the crops being generally grown. It was therefore not surprising to find the farmers of this Colony turning their attention to the production of cotton.

The crop had been grown previously in the Colony, and in many instances with good results, but the lack of suitable machinery militated against the production of cotton on a profitable scale. When it became known that at least 1,000 acres were being put under cotton the erection of a properly equipped ginnery became a more likely proposition. Major A. L. Cooper (at this time operating a ginnery in Natal) decided to erect a ginnery in Salisbury, and handled the total crop produced in this Colony last season.

The cotton seed was imported from the Union of South Africa. About 51 tons of seed were distributed over this Colony and approximately 3,500 acres put under cotton. Practically every district in Southern Rhodesia grew some cotton and added its quota to what will be known as the first commercial cotton crop produced in this Colony. The bulk of the seed was sown late on account of the rainy season being later than usual. The general planting was done about mid-December. The late start was largely compensated for by the season which followed. The rains were, in most areas, well below normal, and the distribution fairly good. The plants did not make heavy growth, and the abundance of hot sunny weather assisted the early maturity of the crop as a whole. It should be pointed out that the heavier soils are, generally speaking, likely to produce a crop which will mature rather later than the crop from the lighter types, therefore the past season was peculiarly suited to the production of cotton on practically every type of soil found in this country. The average yield per acre over the whole Colony was in the region of 600 lb. seed cotton, but yields up to 1,500 lb. of seed cotton were recorded by some growers. The total crop of the country amounted to 1,300 bales of lint, which would bring in an average price of approximately 16*d*. per lb. The value of the crop produced will therefore be about £31,000 for the lint and £15,000 for the seed, making the total £46,000. The cotton seed produced from the crop has all been sold for planting purposes, the price being roughly 3*d*. per lb. The good quality of the crop was very favourably commented upon by persons well qualified to judge, both in this country and abroad.

Belgian Congo.

In the October issue of "*Tropical Agriculture*," page 153, we published some information concerning the development of Belgian Congo. We have recently received a report by Mr. C. K. Ledger, H.M. Consul at Boma, on the economic situation of that Country as it existed in July last. The report contains very interesting information on the resources of the country both agricultural and mineral, and indicates the great progress which has been made by Belgium in opening up, and developing the 900,000 acres which comprise the country. The main difficulty in the way of a more rapid development is the lack of adequate means of transport and communication. The Government has, however, begun very energetically a programme of roads and railways, and the improvement of the navigable waterways. The weak spot in the system occurs in the Leopoldville-Matadi Railway, which at present is unable to handle more than five or six thousand tons of traffic each way per month. In addition there remains the fact that the upriver-vessels are quite incapable of handling the produce which could now be made available. The unfavourable rate of exchange makes it extremely difficult for goods going to or coming from the Congo to support the heavy rates paid in sterling for transport over the Rhodesian railways. The Country lacks an adequate supply of Capital and native labour. It is essential that the standard of life of the native should be raised in order to encourage him in the cultivation of products such as rubber, rice, bananas, cotton, coffee, cocoa and palm trees on a commercial scale. Generally speaking 1922 witnessed a satisfactory recovery from the severe depression of the previous year.

Ecuador.

The most important industry of this country is cacao, 30,879,720 kilograms of which were exported in 1923, to the value of 18,890,358 sucres (1 sucre=2*s*.). Official Statistics of the most important products exported during 1923 also show that the next largest export was Tagua, of which 18,607,912 kilograms of shelled were exported and 4,372,717 of unshelled; 2,719,228 sucres being obtained for the former and 775,061 sucres for the latter. The other exports for the year in order of quantity exported were as follows: fresh fruit (bananas, oranges, &c.) 8,136,600 kilograms (value 419,917 sucres); coffee, 5,601,774 kilograms (value 5,392,374 sucres); sugar, 1,991,152 kilograms (value 764,204 sucres); rice, 1,287,011 kilograms (value 347,037 sucres); cotton, 1,254,583 kilograms (value 1,450,835 sucres); rubber 620,757 kilograms (value 648,928) sucres; Panama hats, 168,903 kilograms (value 2,441,962 sucres).

The Ecuadorian Congress of 1924 has passed a law for the establishment of a Department of Agriculture, and a sum of 179,000 sucres has been assigned from the National Budget for the establishment of Agricultural Experiment Stations and Stock Farms.

Brazil.

There was a considerable decrease in the quantity of produce exported from Brazil during the first six months of 1924. The total weight of shipments was 880,523 tons, as against 1,079,641 tons for the first half of the previous year. As usual, coffee was by far the most important item, and exports at 385,337 tons showed an increase of over 35,000 tons. Manganese ore, however, dropped from 160,265 tons to 72,884 tons, while sugar showed an even more pronounced decrease, totalling only 20,574 tons, as compared with 97,795 tons for the first half of 1923. The export of oilseeds also declined by nearly 2,000 tons, to 57,725 tons, but there was a marked improvement in the frozen and chilled meat trade, the products shipped totalling 59,684 tons, as compared with 44,173 tons for the corresponding period of 1923. An increase was recorded in the shipments of cocoa which totalled 29,165 tons, and on matté which reached 34,195 tons, but timber at 73,221 tons showed a decrease of over 20,000 tons, table fruits at 25,053 tons, a drop of 4,000 tons, while exports of maize totalled only 2,737 tons, as against 25,242 tons in the January-June period of 1923. Tobacco remained about the same at 16,000 tons, hides declined by 4,500 tons to 27,328 tons, and carnauba wax improved slightly, exports totalling for the half year 2,376 tons. Other important products shipped were tallow, 1,331 tons (9,026); rubber, 11,090 tons (9,364); raw cotton, 4,664 tons (9,122); skins, 1,669 tons (2,290); wool, 1,414 tons (867); rice, 4,464 tons (12,257); lard, 922 tons (3,900); jerked beef, 1,467 tons (1,245); preserved meat, 1,055 tons (556); mandioca meal, 1,555 tons (7,014); vegetable oils, 184 tons (692). Imports into Brazil during the first half of 1924 showed an increase of over 420,000 tons, amounting to 2,082,497 tons, but so far as value is concerned there was an increase of £9,452,000 in the value of exports over imports in January-June, 1924.—(*Chamber of Commerce Journal.*)

China.

Reference was made to the position of the cotton industry in China at the annual general meeting of the Cotton Millowners' Association of China held recently at Shanghai. Tests made by the Association with cotton produced at Nanking University have illustrated beyond expectations the fine work that is being done on experimental farms which have produced a commercial cotton from acclimatized American seed and a Chinese variety. Cotton statistics prepared by the Association show that the spindles in China on July 31 of this year totalled 2,742,356, while the spindles in course of erection amounted to 37,680. The quantity of cotton consumed during the six months ended July 31 of last year amounted to 708,203 bales of 500 lb. each. Of this quantity, Chinese cottons were represented by a total of 511,532 bales.—(*Chamber of Commerce Journal.*)

Tanganyika.

In connection with the efforts to develop East African ports, it is officially reported that sanction has been given to an expenditure of approximately £100,000 for improvements to the existing Customs wharf at Dar-es-Salaam. The provision of extra sheds, and transporters direct from the sheds to the wharf, will result in the provision of a complete lighterage wharf.

A further loan has been sanctioned for improvements to Kigoma Port at the Lake Tanganyika end of the Central Railway, which, coupled with certain improvements to the Belgian Concession, will provide quick handling facilities for the Congo transit trade. An ex-German lake steamer has been raised and re-conditioned for this purpose by the Tanganyika Government.

The transit trade *via* the Central Railway to the Eastern Congo is becoming increasingly important as the benefits of the route are better recognized. A growing export of copper billets is coming this way, and all kinds of import merchandise go up the line. It is hoped largely to expand this trade during 1925, provided more rolling stock on either side of the lake is available.

A sum of £50,000 is being applied to extending the Lindi tramway from Ndanda to Lindi Port. This line probably will ultimately be extended to bring the great cotton centre at Machemba in direct touch with Lindi Port, a distance of 150 miles.—(*Times Trade and Engineering Supplement.*)

Sierra Leone.

A sample of coffee beans and one of coffee in cherry have recently been examined at the Imperial Institute, the results of which examinations are published in the last Bulletin issued by the Institute. A firm of importers who were consulted expressed the opinion that there should be a ready sale for consignments of coffee of similar quality to the present sample of husked beans, for consumption in the United Kingdom, and mentioned that the coffee would also be saleable in Holland, Belgium and France, though they doubted whether in these countries it would realize prices as high as in London. The importers further pointed out that in London the product would have the benefit of the preferential duty applicable to coffee produced in British possessions. They stated, however, that after roasting the beans they noticed a slight lack of "cleanness" in the taste, and suggested that care should be taken in curing the coffee in order to avoid this defect. While it is evident that the product represented by the sample would rank as a coffee of somewhat low grade and could not compete with the superior commercial varieties, consigments should be readily saleable, and it has been indicated that if prices such as that quoted for the sample of husked beans (68*s*. per cwt. in bond in London) are likely to be remunerative, the cultivation of coffee in Sierra Leone might well be encouraged.—(*Chamber of Commerce Journal.*)

St. Vincent.

The prosperity of St. Vincent is wholly dependent upon agriculture. Trade improved very considerably, during 1923, the value of the imports showing an increase on the previous year of £10,000 and the value of the exports an increase of no less than £22,000. The export of Sea-Island cotton amounting to 585,143 lb. was a record one, and the prices obtained for arrowroot showed a marked improvement on the previous year, ranging in the neighbourhood of 6*d.* per lb. Syrup and Molasses amounting to 275,932 gallons, valued at £18,711 were exported in 1923, as against 134,786 gallons, of the value of £9,862 in the previous year.

The exports of Copra have increased very considerably during the last few years.

In 1920,	.. 22,644	lb. were	exported.
In 1921,	.. 89,005	do.	do.
In 1922,	.. 222,593	do.	do.
In 1923,	.. 356,626	do.	do.

The Chamber of Agriculture and Commerce, formed early in 1922, continued to function throughout the year and its views were sought from time to time on various subjects of commercial and agricultural importance.

Towards the end of the year the Government acting on the suggestion of the Imperial Commissioner of Agriculture, invited two of the leading engineers of Barbados to report on the cost of establishing a sugar factory and the type of factory required. This question, which has been the subject of considerable discussion, is not yet finally settled.

The dreaded, but not unexpected, Pink Boll worm disease of cotton made its appearance towards the end of the year, having, it is surmised, made its way here from Barbados. The disease has been the subject of careful and anxious investigation and it is to be hoped that with the co-operation of the planters, the legislation and regulations enacted will enable the Colony to emerge successfully from this trial.—Colonial Report No. 1223.

Sumatra.

In Sumatra, writes the correspondent to the *Board of Trade Journal*, agriculture is making great headway; particular mention should be made of the success of the tea gardens centering around Permatang Sianter, where the largest tea factory in these islands was completed in 1922. In West Sumatra Residency, in the neighbourhood of Kepahiang, coffee cultivation is increasing, also at the foot of the Dempo Mountain, in the Palembang Residency, where there is excellent volcanic soil suitable for the growing of coffee, tea, and cinchona.

On the East Coast and in Atjeh and Dependencies much interest is being shown in the cultivation of oil palm, and this industry is increasing rapidly. The planting of rubber trees by the inhabitants throughout the Outer Islands is of the greatest importance, and a native industry has come into being based on scientific knowledge. The number of trees planted yearly is amazing, and there can be no doubt that the native rubber industry of the Netherland East Indies is going to have a yearly increasing influence on the world's rubber markets. The belief in some quarters that this is an ephemeral industry, fostered by present rubber prices and restriction of output in the Straits Settlements and Federated Malay States, is not substantiated. It is an industry which has come to stay. A visit to Djambi, Palembang Residency, or South Borneo will show the sceptical Straits rubber planter that there is no question of killing this industry by over-tapping, shortage of native labour, or such other difficulties as are imagined by those who have not seen the districts in question.

The success of agricultural enterprises in Sumatra is creating considerable local interest, and many Dutch companies are increasing their holdings, while foreign capitalists are sending agents to enquire into the matter of concessions or other possibilities for investments. No doubt great developments will take place in Sumatra in the near future, and nothing but the fear of excessive taxation is holding capital back at the present moment.

Kenya and Uganda.

The Kenya Legislature has adopted the new railway control scheme with certain amendments. A new clause provides that the Legislatures of Kenya and Uganda may, by resolution, on two years' notice terminate the new policy. Another amendment vests the High Commissionership permanently in the Governor of Kenya, the power of the Colonial Office to vary the appointment being removed. The clause providing that railway losses should be met by both Governments (Kenya and Uganda) was rejected.

Owing to increased revenue from Customs and native taxation in 1924 and to departmental savings, the Kenya surplus is estimated at £175,000, instead of the budgeted surplus of £25,000. The most remarkable improvement in the finances is that the floating debt has been almost paid off.

The Colonial Office has sanctioned the expenditure of £5,000 for opening a Kenya Trade and Information Bureau in London in 1925, and a similar sum for participation in the Wembley Exhibition next year, to which the Exhibition authorities are adding 10 per cent. The London Bureau will take charge of Kenya affairs at Wembley.

The new proposal, now approved by the Kenya Legislature, is to create a High Commissionership of Transport for Kenya and Uganda, which will control all the railways, harbours, ports, and steamer services in the two countries. There will be advisory railway and port committees. The Uganda Railway, as a separate entity, will cease to exist. The new title will be "The Kenya and Uganda Railways."—(*Times Trade and Engineering Supplement.*)

Mysore.

The Gersoppa Falls, situated in the Mysore State in South India, are reputed to be the highest falls in the world, the sheer drop of the Rajah, the largest of the four falls, being 829ft. They offer one of the most picturesque views in the whole of the country, and though difficult of access, are visited by a considerable number of travellers every year. The Government of Mysore, which originated the first hydro-electric scheme in the East, the Sivasumudrum scheme, have now carried out a careful survey and prepared a scheme for harnessing these falls.

The importance of the scheme is easily recognized when it is remembered that all this great district is rich in mineral and forest wealth. The Mysore Government are now working, at Bhadravati, a large iron works. At present these depend on wood for their fuel supply, but it is thought that, if this scheme materializes, the smelting could be done by electricity. There is also the question of electrifying the railway known as the Shimoga-Bhatkal Railway, the construction of which has been begun, but is now being delayed for financial reasons, and the uncertainty as to the carrying out of the Bhatkal harbour scheme. Many cotton mills are now at work in the Harihar district, some 70 miles away, and these could be supplied with power. The question of developing the resources of the Malnad districts has long been before the Government, and this scheme appears to offer the opportunity of making a beginning. There is considerable scope for starting a match factory, paper industry, sugar factory, mineral industries, and other industries.—(*The Times Trade and Engineering Supplement.*)

Argentine.

Some interesting figures and comments relating to the sugar cane production of the Argentine for the 1924 season have recently been received from Major R. G. A. Lloyd, D.S.O., British Vice-Consul, Tucuman, Argentine. Statistics are given for 26 factories operating in Tucuman which show that they grew 1,418,528,400 kilos. of sugar cane and purchased a further 1,132,085,350 kilos. from small cane farmers making a total of 2,550,613,750 kilos. crushed by these factories. Of the total of 175,772,492. kilos of sugar produced in Tucuman, 47,219,618 kilos. consisted of Pilé ([1]), 94,255,224 of Granulated and 34,297,650 of Raws. For the other sugar producing areas similar figures are not available but three factories operating in Jujui manufactured 50,275,000 kilos., one factory in Chace 3,538,000 kilos. and Santa Fé and Corrientes 4,110,000 kilos., all raw sugar.

The total sugar production of the Argentine during 1924 was 247,684,492 kilos.

The average annual rainfall for the last forty years is 970 millimetres and falls mostly between November and March. The past year has been one of drought, only 50 per cent. of the normal rainfall having materialised; severe frost also occurred, the lowest temperature registered being 8° Centigrade below Zero. The cane industry in this country is entirely in the hands of native proprietors and is becoming gradually modernized. The varieties of cane cultivated are principally P.O.J. 36 and 213, other varieties being cultivated only in small lots. The principal obstacles to progress in the Argentine sugar industry are indifferent methods of selection of seed and cultivation, and excessive delays between cutting the cane and crushing, such delays causing the average time between cutting and crushing to be 6 days, many greatly exceeding this figure. It is very difficult to obtain reliable information relative to these delays but the figures given may be taken as fairly accurate.

([1]) A molasses sugar resembling muscovado, for local consumption.

Indore.

We learn from Mr. Albert Howard, C.I.E., Director, that a new Research Institute for the improvement of crops, at which special attention will be paid to cotton and to the fundamental problems underlying the production of this crop in India, was formally inaugurated at Indore in Central India on November 24, 1924. The foundation of this new Institute has been rendered possible by the provision of a valuable site of 300 acres by the Indore Durbar, by a grant of two lakhs of rupees (about £15,000) for capital expenditure by the Indian Central Cotton Committee, and by an annual contribution of 120,800 rupees a year (a little more than £9,000) for current expenses in addition to the income derived from the land at the disposal of the Institute. This annual grant has been provided jointly by the Indian Central Cotton Committee and by seven of the Central India States (Indore, Dhar, Jaora, Datia, Rutlam, Dewas Senior Branch, Narsingharh and Sitamau). The control of the Institute has been vested in a governing body of six members with the Agent to the Governor-General in Central India as President. Three members of the Board of Governors are nominated by the Indian Central Cotton Committee, one by Indore Durbar and two by the rest of the contributing States. The Director of the Institute will act as Agricultural Adviser to the States and will in this way come in direct touch with the Malwa plateau, one of the most important cotton tracts in India. The experimental area, which has been leased by the Indore Durbar to the Institute for 99 years at a nominal rent of £20 a year, embraces all the types of black cotton soil met with in India and is very favourably situated for research work on crops. It is close to the City of Indore, now rapidly growing in importance as a commercial, manufacturing and educational centre, and to the cotton mills. The maintenance of an up-to-date library on crop production and the training of post-graduate students, selected by the Indian Central Cotton Committee, will be features of the Institute.

FRUITFULNESS.

Physiological Factors affecting Yield in Tropical Crops.

E. E. Cheesman, B.Sc., A.R.C.S.

In recent numbers of this Journal, mention has been made of researches which show that the onset of the flowering and fruiting stages in plants is probably determined by the relative proportions of carbohydrates and nitrogenous substances in the tissues, or, at least, by some factor intimately connected with the carbohydrate/nitrogen ratio. This ratio is in its turn dependent, partly on the constitution of the plant itself, and partly on such conditions as nitrate supply (controllable by manuring), area of green surface exposed by the plant (controllable to some extent by pruning), and the relative lengths of day and night throughout the life-history.

It may be useful to consider the fruiting habits of certain of the chief tropical crop-plants in the light of this hypothesis, although the attempt must inevitably serve rather as an indication of the scope which exists for physiological research in tropical agriculture than as a record of results achieved.

Cotton.—The Cotton plant has probably been the subject of more physiological research than any other tropical crop-plant, and will therefore serve as a convenient first subject. It is interesting also in that it illustrates very clearly the part played by the hereditary make-up of the plant itself.

The *initiation* of the flowering stage appears to be, at least within ordinary limits, independent of external conditions. The first buds produced by the main axis of the plant, if they develop, give rise to monopodial vegetative branches, repeating the form and structure of the main axis itself. The number of such vegetative branches produced is definite and characteristic for any given pure strain ; if it is low, as in Upland varieties, the strain fruits early, and is suitable for cultivation as an annual ; if it is high, fruit production is late, and the strain is perennial, like the native West Indian " kidney " cottons. All subsequent branches are fruiting branches, and are of a different type, known botanically as " sympodial ;" they have a flower-bud at every node.

Although the flower-buds are thus initiated at a definite point in the development of the plant, it does not follow that they will mature. Under adverse conditions many are shed when very young, and since conditions favouring fruit-setting are not necessarily the same as those favouring flowering, even if all the buds develop to perfect flowers and open, the young bolls may be shed a few days later. The final yield, therefore, depends largely on the amount of bud-shedding and boll-shedding, and it is in this connection that the carbohydrate/nitrogen ratio is possibly important.

This point must not be over-emphasised, for there is abundant evidence that shedding in cotton is very commonly due to deficiencies in the water supply. Balls in Egypt, and Lloyd in Alabama, found shedding to be directly due to water-shortage, and the observations of other workers in the United States point in the same direction. Under humid conditions in St. Vincent shedding is most severe after heavy rains, and Harland has suggested (*West Indian Bulletin* 16 p. 197) that the rainfall causes root asphyxiation, absorption being hindered as a result. Further, Dr. S. C. Harland informs the writer that a West Indian perennial cotton which he budded on a Sea Island stock produced over 600 flowers in a season, yet set not a single boll, whilst the reciprocal budding of Sea Island on perennial set bolls freely, the presumption being that the water supplied by the Sea Island root was inadequate for the more vigorous scion.

The hereditary constitution of the plant comes into prominence again when we remember that some strains of cotton shed far less than others under identical external conditions.

Nevertheless, when all this evidence is taken into account, the possibility remains that the carbohydrate/nitrogen ratio is also concerned in shedding. T. G. Mason ("Growth and Abscission in Sea Island Cotton " *Annals of Botany* Vol. 36 pp. 457-483. 1922) found that any check in the rate at which food was synthesised by the plant, such, for example, as that caused by partial defoliation, increased the rate of shedding, and in another paper (*West Indian Bulletin* 19 pp. 214-238) he showed that pruning off the vegetative branches of Sea Island cotton caused a somewhat more rapid elongation of the main axis, and production of more nodes on the individual fruiting branches. He suggested that the more limited development of the unpruned plants was due to the removal of growth-promoting substances by the vegetative branches, and that the movement of these substances was intimately associated with the translocation of carbohydrates.

Citrus.—The application of carbohydrate/nitrogen ratio principles to pruning operations has been pointed out by R. W. Hodgson (" The Pruning of Citrus Trees in California." *Univ. Calif. Agric. Expt. Sta. Bull.* 363. 1923). His remarks would apply with equal force to many other fruit trees, although certain modifications would be necessary in the case of deciduous trees where a definite rest-period somewhat complicates the life history.

For the young tree in fertile soil the nitrogen supply is ample, but its leaf-area being relatively small, the carbohydrate synthesis is low, and as a result the first few years of its life are spent in vegetative growth. As the leaf-surface continually increases, the carbohydrate supply rises until the conditions for fruitfulness are attained. Left to itself, the tree will gradually exhaust the nitrogen of the soil, and decline from nitrogen starvation ; if, on the other hand, this is

prevented by manuring, any factor decreasing the manufacturing power of the leaves causes unfruitfulness from carbohydrate deficiency. Thus heavy pruning of trees in good bearing condition is bad, as it tends to induce vegetation. Pruning of an old tree, however, may actually increase the carbohydrates, if so arranged as to remove old and moribund branches and cause the development in their place of new shoots with a more vigorous and efficient leaf surface.

Nitrogen starvation may evidently be remedied in either of two ways, by adding nitrogenous manures, or by pruning to reduce the carbohydrate supply to a level consistent with the available nitrogen. The former is obviously the better, since in that case fruit production is graded up to the full use of the carbohydrate available, and the yield will be greater than by the alternative method.

It is an interesting fact that Citrus trees affected by root diseases often produce an exceptionally heavy crop of fruit just before they die. This may be due to a decrease in the water-supply following the root damage, or to a decrease in the nitrogen from the same cause. There is the third possibility that these two factors are not really distinct, and that any reduction of the water-content of the tissues disturbs the carbohydrate/nitrogen ratio. T. Horn (*Bot. Archiv.* 3 pp. 137-172. 1923) has shown that in leaves decreasing water-content causes considerable changes in the relative amounts of the various carbohydrates present.

CACAO.—Whilst the general principles of application will be the same for cacao as for Citrus, the former presents several interesting features of its own. The individuality of the tree is again marked here, for one often sees one tree bearing a plentiful show of flowers whilst the next, under apparently similar conditions, has few or none.

The limits for flower-production seem to be wide, since most trees bear at least a few flowers through the greater part of the year; the much greater numbers produced at certain times of the year may indicate a seasonal fluctuation of the ratio, due to photoperiodism or some other cause.

Abscission of the flowers is again an important factor influencing yield, and although much of the flower-shedding is probably due to lack of pollination, the proportion of shedding on some trees even after hand-pollination of the flowers (S. C. Harland, Unpublished observations) shows that this is not the only cause operating. Another frequent cause of low yield is the drying up of young pods, which seems specially liable to occur when large numbers have set.

Carbohydrate/nitrogen ratio might well prove to be concerned in both cases, and if this were established it is not unlikely that manuring and pruning could be adjusted to improve substantially the present yield. At present, however, there is no direct evidence available to support what must therefore remain a mere suggestion.

COCONUT.—As one of the most valuable crops of the Tropics, the coconut palm must be mentioned, but unfortunately the available data are too meagre for satisfactory treatment. In all probability the same general principles hold good, but many modifications in treatment are necessitated by the fact that the palm, as a member of the group of plants known as Monocotyledons, has a structure very different from that of, say, a cacao tree. Pruning, of course is out of the question, but the carbohydrate/nitrogen ratio can still be controlled to a great extent by judicious manuring. After reaching the bearing stage, which is presumably initiated as soon as the leaf-surface is large enough to provide the right carbohydrate supply, the palm has a potential fruit-bud in the axil of every leaf. The conditions for maximum yield would seem to be, that the crown of leaves should be kept free from all pests and diseases which will interfere with carbohydrate manufacture, and the nitrogen supply then adjusted, by manuring, to give the best results with the available carbohydrate. As in all other cases where crops are of mixed parentage, the best of treatment will give different results with different trees, but the selection of trees with the best possibilities is another subject, and does not concern the present article.

"REVIEW."

"RICE—Its Cultivation and Preparation" by Charles E. Douglas, Sir Isaac Pitman & Sons, Ltd., London, 143 pp. Price 3*s*.

This is a handy little volume recently added to the list in the publishers' Common Commodities and Industries Series.

As is natural in a book of this size and considering the uses for which it is intended, no attempt has been made to deal exhaustively with the subject, although the chapters treating more particularly with the handling and preparation for market are given nearly two-thirds of the space, thus differing from Copeland's much larger work previously reviewed in this Journal, in which the agriculture and botany of rice, its distribution and importance in the various countries are emphasized. With these aspects the first few chapters of the present volume briefly deal. We think the strictly agricultural matter might have been improved if a little more discussion had been given, in the first place, to the fundamental requirements of the crop. Twenty-five illustrations are included.

The book is written in terse and easy style, well adapted to the use of schools and colleges where it is desired to stimulate interest in the common commodities of life. On the other hand, the more advanced student, the grower, the miller and the casual seeker of knowledge will find it alike a most useful companion.

J. S. D.

COLLEGE GEOLOGICAL STUDIES.

PROF. F. HARDY, M.A.

THE last annual report of the Colonial Research Committee (1923) contains a statement by Dr. J. W. Evans, F.R.S. (Appendix II, p. 10), that it is "rather surprising to learn that geology is not among the subjects taught at the Agricultural College in Trinidad." This statement is not quite correct, and it is necessary to offer some explanation in order to prevent further possible misunderstanding.

The first prospectus of the College curriculum (1922) definitely included geology as a separate subject of the Diploma Course. This arrangement was strictly followed in the academical year, October, 1922 to June, 1923—formal lectures in geology being delivered for two terms, making a total of 36 hours devoted to the subject. This led up to, and was followed by, a one term's course (18 hours) of elementary soil science. The geological teaching included a study of the common rock-forming minerals; igneous, sedimentary and metamorphic rock types; weathering, transportation and corrasion; the outlines of stratigraphical geology; elementary palaeontology, and the geological history of the British West Indies. It was amplified by practical demonstrations with the aid of a series of representative hand specimens.

During the next academic year (October, 1923, to June, 1924), the scope of the general teaching of the College was considerably widened, fresh subjects, such as mathematics, agricultural history and commercial geography, being introduced into the work of the first year. In consequence, and in view of the fact that most of the entering students possessed inadequate knowledge of mathematics, chemistry, physics and biology, and required additional teaching in these fundamental subjects, it was decided after due deliberation, to postpone the teaching of soil science to the second year, and to curtail the teaching of geology to a one term's course. This necessitated a discontinuation of the course on stratigraphical geology, although a short course on the geology of the West Indies was given to Post Graduate Students, who afterwards visited certain West Indian Islands to study cotton cultivation.

During the present academic year (October, 1924, to June, 1925), no geological teaching so far has been offered. It is intended later, however, to repeat the one term's course on elementary petrology and physical geology to first year men, provided time can be found for it, and again to offer a short optional course on West Indian stratigraphy. The teaching of soil science to the second year will continue to have a geological bias, because an advanced third year course on plant ecology, attended also by Post Graduate Students, amply describes the more specialized physico-chemical aspects of modern soil science.

Dr. Evans' opinion that "it is impossible to exaggerate the value of even an elementary knowledge of the subject (geology) to the agriculturists" is more or less in keeping with the views of the staff of the College, but it is believed that first preference should be given to the teaching of more fundamental subjects such as chemistry, physics and biology, rather than to descriptive subjects which a student is better able to acquire by his own endeavour. The College syllabus is still very extensive, and it is regrettable that time cannot be found, not only for additional geology, but also for a more detailed study of subjects such as meteorology, forestry, agricultural engineering, dairying, food chemistry, physiological chemistry and animal nutrition, which, in the present curriculum, receive brief and probably inadequate consideration at least in so far as the needs of the specialist are concerned. In any case, provision will be made for students who desire to further their knowledge of these and other subjects after they have completed the Diploma Course.

NEW CROPS IN MALAYA.

THE rise of the plantation rubber industry in Malaya constitutes one of the most fascinating stories of tropical development. In 1900 the world production of rubber amounted to 53,890 tons, of which only 4 tons consisted of plantation rubber. In 1922 the exports of plantation rubber from the Federated Malay States alone, had increased to 128,461 tons. In 1920 the production of plantation and wild rubber totalled 370,000 tons of which Malaya produced 57·5 per cent., Ceylon 12·5, Netherland East Indies 25·5, South India and Burma 2·0 and other countries 2·5 per cent.

The output of wild rubber, once the sole supply, had become negligible, but the product of plantation rubber had increased at such an enormous rate that the increase in demand had been far outstripped, and prices fell to unremunerative levels. In consequence the rubber planters, with the assistance of the Government, agreed upon a restriction of output based upon an agreed standard production. The result was for a time very successful but, as was pointed out in a previous issue of this Journal (*Trop. Agr.* Vol. I. No. 12. p. 190), new plantings since the introduction of this system are likely to result in an even worse period of over-production.

In view of this fact it is essential, as we have already pointed out (*see* above reference), that no additional rubber plantations should be begun, but that energy should be devoted to the production of other crops, so as to broaden the economic foundation of the Colony and reduce the degree of dependence upon a single product. In this connection Messrs. B. Bunting and C. D. V. Georgi have contributed an interesting joint article to a recent number of *The Planter* on "Some Potential Industries" for Malaya. They point out that while the phenomenal success of the plantation rubber industry led to the decline of many other well established crops yielding smaller

returns, and absorbed the surplus labour so rapidly that additional labourers had to be secured from neighbouring countries, the cultivation of both padi and coconuts, both essentially native industries, had nevertheless developed. The following figures which are an estimate of the conditions existing in 1920, give an indication of the comparative importance of the more important crops.

Table showing estimated area planted under various crops in British Malaya in 1920.

Rubber	2,000,000	acres
Padi	600,000	,,
Coconuts	400,000	,,

Of the area under rubber, approximately one-half was being cultivated upon large plantations and the other half by Asiatic small holders. The cultivation of padi was entirely in the hands of natives, while coconuts were planted to the extent of one-third under estate conditions and the remaining two-thirds by small-holders. The difficulties in the way of encouraging the increased production of other crops lay in the fact that the slump which existed in rubber also existed to varying extents among other crops. There are crops, however, which, although not in sufficient demand at remunerative prices at the moment to warrant any very great extension in planting, hold out considerable promise for the future, the main difficulty being that few estates possess sufficient reserve capital or land to undertake production upon a large scale. The various crops can be divided roughly into 3 classes, *viz*:

(*a*) crops suitable for large scale production,

(*b*) crops suitable for small scale production, and

(*c*) crops which do not require elaborate machinery or plant, which are specially suited to the native cultivator.

The authors then proceed to discuss the qualifications of various crops in reference to these various requirements. One of the most promising crops is the African oil palm which yields two distinct oils, palm oil, present in the pericarp, and palm kernel oil from the kernel. Palm oil is used for a variety of purposes largely dictated according to its free fatty acid content. Oil of low grade is used largely in the preparation of soaps, lubricating greases, candles and the manufacture of tin plate, while high grade palm oil is used as a basis for the preparation of substitutes for butter and cooking fats. Palm kernel oil is used principally in the preparation of edible fats, while smaller quantities are utilised in the soap-making industry. The residual meal or cake remaining after the extraction of the oil is an important feeding stuff.

At present about 5,000 acres of oil palm have been planted of which 1,000 acres are in bearing. The results obtained in the neighbouring island of Sumatra, where the palm is being cultivated on a large scale, are sufficiently encouraging to warrant a considerable extension in Malaya, provided suitable land is available. The nature of the fruit makes it necessary to treat the pericarp immediately after gathering, if a high grade oil is required, and since this involves the erection of a factory with expensive machinery, it is essential that the plant should be grown on a large plantation, unless arrangements can be made for a number of smaller estates to erect a central factory. The increasingly varied uses for both kinds of oil indicate that in all probability the present level of prices will be maintained. There are a number of other oil-yielding plants such as ground nuts, gingelly and castor suitable for the small native cultivator. Of essential oil crops perhaps the only one which can safely be recommended is citronella grass for which there exists a steady demand for scenting soaps and preparing various artificial perfumes. The extraction of the oil is a simple operation involving only a steam distillation of the freshly dried grass. The oil from local grass is similar to the Java type which commands a higher price than Ceylon oil, but as with all essential oils, the production of citronella oil cannot be recommended on a large scale. Other essential oils such as lemon grass and patchouli can be produced but the demand is somewhat uncertain.

Development night also be possible in the production of various fibres. Sisal hemp is a fibre obtained from a species of *Agave*, a perennial plant with a life of about eight years. Since it requires plant and machinery for the extraction of the fibre it would have to be cultivated on a large scale and, although this has not yet been attempted in Malaya, the results obtained from small experimental areas are promising, and its extended cultivation is worthy of serious consideration. Manila hemp is a fibre obtained from a species of banana, known as Musa textilis, which is indigenous to the Philippines and cultivated there on an extensive scale. While suitable to local conditions it would be necessary to cultivate it upon a large scale in order to enable grading of the fibre to be carried out.

Roselle fibre is obtained from a species of Hibiscus, which, like the jute plant, is an annual, and grown preferably as a rotation crop. While not in the same class as either Manila or Sisal hemps, a large amount would probably be absorbed for the manufacture of cordage and binder twine if regular supplies were forthcoming. Kapok fibre, which is derived from the fruits of the Kapok tree (*Eriodendron anfractuosum*), is probably the finest fibre for stuffing and filling purposes and upholstery work, and as such is in constant demand. Owing to its lightness and buoyancy, combined with its non-absorbent qualities in respect of water, it is also used extensively in life-saving apparatus. Expensive machinery is not required for the extraction of this fibre and the seed can be utilised for the production of oil. It might be developed, either on small holdings, as in Java and to a less extent in Ceylon, or as a subsidiary crop on estates.

Some consideration is also given to the production of food crops. Tapioca (or cassava), the roots of which yield the tapioca of commerce,

is probably one of the oldest established crops in Malaya and other tropical countries. Tapioca contains a large proportion of starch and, in addition to its use as a foodstuff, is employed for the production of starch, glucose and dextrim. The starch is employed in the preparation of adhesives and for the sizing of yarns and fabrics. On account of the high yield of root and starch content, the roots from the tapioca plant may be considered as a possible source of alcohol for power purposes. The low prices realised during recent years resulted in its neglect in Malaya, but the recent advance in price has rendered the cultivation profitable. If used for purposes other than local food production, machinery, not of a complicated nature, is needed. It is essential that the crop should be cultivated in rotation with other crops and experiments upon these lines are being carried out at the Government Experiment Plantation, Serdang.

At one time sugar-cane was extensively cultivated in Malaya on the flat coastal regions but the superior attractions of rubber and the development of beet sugar in Europe caused most cultivators to abandon this particular crop. The present higher prices may cause a revival of this industry especially if the molasses is utilised for the production of power alcohol.

Coffee, too, was grown extensively prior to the introduction of rubber, although the fluctuations in prices and the development of the crop in Brazil prevented it from becoming a staple industry. The disease (Hemileia Vastatrix) which practically destroyed the industry in Ceylon and India was also responsible for its abandonment in Malaya. The type under cultivation was the Liberian which is particularly susceptible to the disease, but since then the Robusta and some high-yielding disease resistant hybrid varieties have been introduced.

The production and canning of pineapples is an old established industry which became moribund during the war. To some extent this industry has been revived and might be developed further if more attention were given to grading before canning.

Turning to spices we find that cloves and nutmegs, which have been cultivated in Malaya from the time of the earliest settlements, have both declined in importance owing to the demands of rubber and to a less extent of coconuts. Both crops thrive best near the sea and are suitable for small cultivators, so that an extension, while possible, is limited.

Ipecacuanha has been grown successfully for a long time in the Colony but the demand is limited, and any attempt to cultivate the plant on a large scale would considerably reduce the value of the roots, which are used principally for the extraction of emetine, a specific extensively employed for dysentery.

Among miscellaneous crops are mentioned limes, which are used for beverages and in the preparation of citric acid for the dyeing and textile industries. The West Indian lime is at present unable to compete successfully with the Italian lemon and it is suggested that the limes should be exported as fresh fruit.

The cultivation of the Derris (Tuba) plant the root of which supplies an aqueous extract useful as an insecticide, might be extended.

The nipah palm which grows wild on the banks of tidal rivers and in coastal swamps of the Peninsula, forms one of the most promising sources of power alcohol. Experiments are being carried out by the Department of Agriculture to investigate its possibilities under cultivated conditions.

The production of Gambier, an extract of which is used as a tanning material, might be extended as the present prices yield a good margin of profit.

It will be noted that although many of the crops are only suitable for cultivation on a small scale, much may be done between estates by co-operating to produce and maintain the necessary quantities of any particular product for it to become established in the market. In the past many agricultural enterprises have failed because sufficient quantities of the product were not forthcoming at regular periods to create the necessary demand.

The object of the article in question by these two authors has been to direct attention to the possibility of introducing new agricultural industries. While there may be a revival in the prosperity of the rubber industry it is obvious that the broader the economic basis of the country the less possibility is there of a depression in any particular crop involving with it a depression in the whole country. All countries, in which prosperity depends upon one particular industry, are liable to severe and sometimes continued periods of depression. While means can be devised to adjust the production to meet consumption at a more profitable level of prices, the only safeguard is to lessen the country's dependence upon this one particular crop by introducing other crops which, as far as can be ascertained, are not likely to be involved in a depression at the same time as the staple industry. Several industries have been suggested which might well tend to alleviate the depression caused by over-production in rubber. The authors are to be commended for the cautious way in which they have approached the subject and the care with which they have indicated both the limitations and the possibilities of the various alternative crops. It is not suggested that any considerable area now under rubber should be abandoned, but rather that additional planting should be confined to other crops, instead of increasing the area already under rubber. The suggestions should command the respect and attention of all engaged in planting in Malaya.

C. Y. S.

CACAO.

Some Botanical Problems.

S. C. HARLAND, D.Sc. (Lond.), F.L.S.

[*The following article forms the substance of a recent address by Prof. Harland to the Trinidad and Tobago Agricultural Society.*]

ONE of the most striking features of a cacao plantation is the enormous variation in yield from tree to tree. Of two trees both apparently similar in healthiness and vegetative vigour one will yield a hundred or more pods and the other few or none. A similar situation is characteristic of other tropical tree crops, for example, it has been noted in the East in rubber that 75 per cent. of the crop is often being produced by less than 30 per cent. of the trees. This means that a large number of trees are not paying for their keep and may be described as 'boarders.' The situation is most nearly analogous to that existing in a commercial herd of dairy cows. As long as the farmer is content to record the amount of milk he receives only in bulk, he cannot take any steps towards improvement, but when he begins to record the individual milk yields he soon discovers that certain cows are not worth keeping and replaces them by better animals. To analyse a little further, the low milk yield of some cows may be due to inadequate nourishment or to disease, but everyone knows that if a cow is inherently a poor yielder, no amount of care and attention will ever effect any improvement. As we say in Yorkshire, "You can't get a quart out of a pint pot."

It is enormously important for the cacao planter to eliminate the poor yielding trees, and to replace them with heavy bearing types. But before we can do this a certain amount of initial study is necessary on the way in which the yield of a cacao tree is built up. In the first place pods come from flowers, and we have to decide first whether the small yield of pods in some trees is due to a correspondingly small number of flowers. A little study will show that as a rule the number of flowers has very little, if at all, to do with the size of the crop, and it is often the case that the unproductive and barren trees are producing large flushes of flowers but are not setting any pods.

Since mere number of flowers is not of great importance it is clear that a study of the pollination and the setting of fruit in cacao is an essential preliminary to the wider question of how yield is built up. We have carried out an extensive series of experiments at the College on the question of pollination and our results may be briefly summarised as follows :—

1. Direct observations by the microscope have shown that only about 5 per cent. of flowers ever received any pollen on their stigmas at all and 95 per cent. are therefore doomed to pass through their life history without any chance to set fruit.

2. If flowers are hand-pollinated there is a survival of 5 per cent. of the flowers on the 10th day, at which time small fruits have developed of 2-3 mm. in diameter. After this period there is practically no further loss by mere shedding, though many fruits fail to reach maturity either through disease or lack of nutrition.

3. The setting percentage of 5 per cent. in hand-pollinated flowers should be compared with the figure 0·3 per cent. in non-pollinated flowers.

4. In flowers attended by ants and aphides, about 2 per cent. of setting occurs and we have calculated that efficient pollination takes place in about 35 per cent. of flowers attended by ants and aphides.

5. The results of flower examination, involving the recording of the history of nearly 4,500 flowers by my assistant Mr. G. O. Johnson, have established beyond reasonable doubt that either ants or aphides, or both these insects, are responsible for a considerable amount of pollination, and the low percentage of setting on control flowers renders it likely that they constitute the chief pollinating agents at the St. Augustine Experiment Station where our experiments were carried out. It is conceivable that thrips of the flower-inhabiting type (not the injurious species), also play some role, but they were practically absent in our material.

6. Elimination of crawling insects by bands of an adhesive substance demonstrated the presence of another pollinating agent, probably a night-flying insect which efficiently pollinated about 1 per cent. of flowers.

We can now proceed a step further. Though the percentage of pollination is small and the percentage of flowers which set fruit seldom rises above 5 per cent., it is probable that lack of pollination is never the main cause of a poor crop, for nature provides such an enormous number of flowers that the setting of even one in a thousand would produce a heavy crop. Our experiments in hand-pollination led us, however, to an important conclusion. In certain trees—unproductive trees, several hundred flowers were pollinated without a single pod being set, but on other trees—good bearing trees, a large number of pods could be set at any time by hand pollination. We have thus arrived at what is probably the main factor distinguishing productive from unproductive trees ; the former are good 'setters' and the latter bad 'setters.' It is clear that from the practical point of view the elimination of poor 'setters' is entirely feasible, and the breeding out of a strain of high setting capacity could be done without the slightest difficulty. Certain varieties of cotton for example suffer unduly from the shedding of buds, flowers, and young fruits, and it has been possible to isolate strains comparatively free from shedding.

The breeding of a variety or varieties of cacao of uniformly high productivity offers a few difficulties which merit some discussion. A tree may be regarded as the resultant of the interaction of its hereditary factors plus its environment. There is

no such thing as a cacao which breeds true to type, for we have shown by methods which are somewhat too detailed to relate here that cacao is cross-fertilised in Trinidad to the extent of about 30 per cent. There is a kind of tree which occurs sporadically on estates under the name of 'Male Cacao,' which is characterised by complete sterility of the anthers and should therefore be more properly termed 'Female Cacao.' Examination of the stigmas of flowers of such a tree will show that pollen is being conveyed from neighbouring trees, probably by an unknown night-flying insect.

The existence of such a large amount of natural crossing means that the cacao trees of Trinidad are a set of extremely complex hybrids, whose progeny show the usual type of Mendelian segregation. The main fact about a hybrid is that it cannot breed true, so that the mere taking of seed from high-bearing trees will not insure a high bearing progeny. Nevertheless, the progeny of some trees will show a higher mean yield than the progeny of other trees, and what must be looked for first is the ability to transmit yield rather than the actual yield of a tree itself. Boiled down, the theory of breeding cacao is this, that the value of a tree for seed purposes can only be estimated by taking the average yield of its daughter trees, and using this as a basis for selection. I need not elaborate the theory any further; its exact working out is somewhat difficult and demands a knowledge of the working principles of genetics. But in closing my remarks on breeding for high productivity in cacao I shall draw your serious attention to the fact that while the entomologist and mycologist have had a fair scope for their work, the specialist in plant breeding has never had a chance and it is time that he had one. If you had a cacao experiment station in which a hundred self-fertilised progeny were grown in rows from each of 500 high bearing parents from all over the island, it would not take more than a few years, say three generations, before trees guaranteed for high productivity would be available for wide distribution.

To turn for a moment to another aspect of yield. It has been thought that by using budded trees from known heavy bearers fields of uniformly high productivity could be obtained. There are, however, difficulties in the way of such a supposition. In the first place, it has been shown that yield depends considerably on 'setting capacity.' When you bud a tree, does the 'setting capacity' follow that of the stock which is an unknown quantity, or does it follow that of the scion? There are many reasons for believing that the stock in this connection is at least as important as the scion, and it has been shown in cotton that a shedder can be partially converted into a non-shedder by the employment of a suitable stock. The converse of this is also true. Experiments with grafted and budded rubber in the East have also led to the conclusion that the stock is of very great importance in influencing yield, and the Dutch workers are now of the opinion that the only test of the value of a tree for budding purposes must be based on an examination of its vegetative descendants. If a tree produces good vegetative offspring it is a good tree; if it does not, it is a bad tree. The figures obtained for the yields of budded cacao at River Estate indicate that some of the budded strains are good, while others are decidedly bad. I believe that there is room for both budded and seedling cacao in Trinidad, but the future for the latter is probably greater. It is important to note also that the seeds from budded cacao though uniform in size need not necessarily be uniform in quality, for if a budded Forestero tree is pollinated by Criollo pollen the resulting seeds will probably partake somewhat of the Criollo quality. That is, Mendelian segregation may take place in a single pod with respect to quality and there may be half-a-dozen qualities present in such a pod. The unit of quality must therefore be taken as the single bean.

Before closing, I should like to emphasize the point that the manufacturing end of the cacao industry is a quarter of a century behind that of the cotton industry in its attitude towards its raw material. The cotton spinner now realises that uniformity of quality is based on pure strains of cotton, and he realises that all his manufacturing processes are based on the behaviour of a single cotton hair as the unit. When the cacao manufacturer realises the importance of linking up his activities with those of the grower, we shall then, and not until then, be able to breed cacao for quality. At present we cannot do this because the manufacturer has not reduced his definition of quality to exact scientific terms and until quality is analysed in a precise manner from the chemical, physical, and botanical points of view the plant breeder will continue to be held up.

COTTON SEED.

G. N. Blackshaw, O.B.E., B.Sc., F.I.C.

Enquiries have been received concerning the feeding of surplus cotton seed to farm animals. Many years ago a considerable quantity of raw, roasted, steamed or boiled cotton seed was used for feeding, but the practice of rationing animals with raw cotton seed has been largely abandoned because the seed now finds a market at the oil factory, and the residue after the extraction of oil is more suitable for feeding than the entire seed.

Care has to be exercised in feeding whole cotton seed to animals, since it is liable to cause poisoning and diarrhoea, especially in young stock. It is not usual, on that account, to feed raw cotton seed to young stock or to pigs, nor is it advisable to feed it to animals in advanced pregnancy or to those suckling their young. The use of mouldy or heated seed for feeding purposes should be avoided.

Regarding the daily ration of cotton seed, information gathered from American and other sources indicates the advisability of not exceeding about 4 lb. per day for fattening animals, or 2 lb. for milch cows per 1,000 lb. live weight.

Cotton seed produces a dry, hard and colourless butter if fed liberally to milch cows.—(*The Rhodesian Agricultural Journal.*)

SPACING EXPERIMENTS.

A New Method.

PROF. S. C HARLAND, D.SC. (Lond.), F.L.S.

THE yield of a crop is essentially determined by the interaction of two main factors, (*a*) yield per plant, (*b*) number of plants per acre. A study of the optimum number of plants per acre thus becomes of extreme importance, particularly when the crop is introduced into a new country where an agricultural tradition in regard to its spacing requirements is lacking. It is clear of course that the results of a spacing experiment are valid only for the particular site and season in which it is carried out, and it is therefore all the more important to elaborate a spacing technique which is easier to carry out than the more formal method of using a number of scattered plots devoted to different types of spacing.

A method has been devised by the writer which appears to be quite new, and preliminary experiments with cowpeas indicate that it may be of wide application to other crops.

The method briefly consists in spacing the plants along the row in a series of gradually diminishing distances. Thus, the distance between the first two plants in the row may be 2 ft. 6 in. between the second and third 2 ft. 5½ in., between the third and fourth 2 ft. 5 in., and so on, until the distance becomes very close, say 2-3 inches. The distance between the rows themselves will be uniform, and successive experiments should be carried out in which the distance between the rows is varied.

In order to insure a smooth curve the mean yield of not less than 50 plants at each spacing point should be determined, and if possible the probable error of each series calculated. The results may be presented in a curve in which number of plants per acre is plotted against yield per plant, and against yield per acre.

It is evident that the results will fall into a curve which will ascend gradually until the optimum spacing is reached. After this it may present little variation over a fairly wide range of spacings, but will ultimately descend as spacing becomes very dense. The results of experiments with cowpeas will be published in full elsewhere, but it is thought advisable to publish the method as it stands in the hope that it will prove useful to workers with other crops.

The Editor regrets that through an error in the office several circulars, purporting to remind readers that their subscriptions were due, were sent out to new readers. The Editor trusts that these readers will consider the circulars as not having been received.

COLLEGE NEWS.

Lady Solomon and Mrs. Sapte visited the College.

Mrs. Deane and Mrs. L. Scott de Verteuil visited the College, and were shown round the new College Buildings.

The Hon. Mr. and Mrs. Logan and Mrs. Carlton Browne, of the Canadian Delegation, accompanied by the Hon. T. A. V. Best, Colonial Secretary, paid a visit to the Imperial College on the afternoon of Thursday, January 22.

Mr. L. H. Burd, Cotton Research Assistant of St. Vincent, visited the College in connection with the investigations being carried on as to the possibility of establishing a Cotton Research Station in the Island.

Dr. H. Prinsen Geerligs, noted author and sugar technologist, visited the College grounds on Sunday afternoon and inspected the new sugar factory. He was shown around by the Principal and Sir Francis Watts, and was highly pleased with the possibilities of the Experimental Factory.

Prof. J. Bretland Farmer, F.R.S., Professor of Botany, Imperial College of Science and Technology, Member of the Governing Body of the Imperial College of Tropical Agriculture and Member of the Executive Committee of the Empire Cotton Growing Corporation, and Mr. L. G. Kilby, Secretary of the Empire Cotton Growing Corporation, arrived in Trinidad on January 25, to investigate the possibility of establishing a Cotton Research Station, under the auspices of the Empire Cotton Growing Corporation.

On Thursday, January 29, the Students' Union of the Imperial College of Tropical Agriculture defeated the St. Augustine Club in a tennis tournament. The following are the results :— Mr. S. H. Evelyn (Capt.) and Mr. J. A. MacDonald beat Mr. C. Green and Mr. M. Farfan, 6-4, 9-7, 3-6, 6-3 ; Mr. W. C. Lester-Smith and Mr. W. T. O. Maidment beat Mr. S. F. Ashby, and Mr. L. Tuck 6-2, 6-4, 9-7 ; and Mr. P. D. R. Bovell and Mr. H. Vilain lost to Mr. J. Agostini and Mr.H. Hutton, 8-6, 2-6, 2-6, 4-6.

With this issue of *Tropical Agriculture* we publish a supplement on the New College Building which is rapidly nearing completion. The supplement contains articles by Sir Francis Watts, K.C.M.G., D.SC., *Principal Emeritus*, H. M. Leake, M.A., SC.D. (Cantab), F.L.S., *Principal*, and Major H. C. Corlette, O.B.E., F.S.A., F.R.I.B.A., *Architect*, and photographs of the Foundation Stone, the New College Building, and plans showing the allocation of the rooms between the various faculties.

Several subscribers have returned copies of Vol. I, Nos. 1, 7 and 9 without disclosing their name and address and the Editor tenders his best thanks to these unknown subscribers for the copies received.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Spot prices for all types of sugar are somewhat lower since our last issue though changes are somewhat irregular. It is evident, from market reports, that the trade is anticipating a further decline from prevailing prices owing to the reports of a heavy increase in the world's production.

COTTON.—Prices have declined from 13·65*d.* per lb. on December 30 to 13·10*d.* per lb. on January 7, but at the time of going to press the decline appears to be over and trade is steady with a strong undercurrent of strength.

CACAO.—Cacao has declined to 14¼ cents per lb. New York but in London remains steadier than either tea or coffee, averaging 85*s.* to 86*s.* per cwt. for Trinidad Good Middling. Accra fermented realises 41*s.* 3*d.*

COFFEE.—Coffee after rising rapidly towards the end of the year has tended to favour buyers slightly in the New Year. Brazil Santos, after rising to 126*s.* per cwt. on December 31, has declined to 124*s.* on January 7. Costa Rica Middling at 174*s.*, Mysore Middling at 166*s.* and Kenya Good Middling at 162*s.*, have remained very steady from December 24 to January 7 but prices cannot be considered as settled as there is a considerable difference between the prices offered by purchasers and the prices at which holders are willing to ship.

TEA.—The first auctions of tea during 1925 have resulted in a slight decline of about one half-penny per lb. in order to effect sales. On January 7, averages were :—Ceylon 23·84*d.*, Indian 22·64*d.*, and Java 18·68*d.*, each per lb., spot, London.

SISAL AND HEMP.—Both Prime Sisal and Manila showed a tendency to rise after December 17, Manila reaching £56 10*s.* per ton on January 7, but Prime Sisal, after rising to £49 10*s.* on December 31, later declined to £48 10*s.* on January 7. Returns indicate that production increased during 1924 but barely sufficiently to meet the increased demand.

RUBBER.—Crêpe rubber reached 20*d.* per lb. on December 31 and has remained steady at that price up to the time of going to press. Stocks in London on January 3 were reported to have fallen to 29,700 tons so that the year opened with the situation well in hand, but stocks in America are reported to be considerable. Hard Para realised 17½*d.* and Soft Para 14½*d.* per lb. on January 7.

RICE.—Rice has not been at all a brisk trade, Burmese declining to 18*s.* per cwt. on January 7 but Carolina has again risen from 35*s.* to 36*s.* per cwt.

EDITORIAL NOTES.

THE Review of "The Trade Commerce and Shipping of the Empire," by Sir Charles McLeod and Professor A. W. Kirkaldy, M.A., B.Litt. (Oxon). which appeared in the last issue of *Tropical Agriculture*, Vol. II, No. 2. Page 42, was written by H. Martin Leake, M.A., SC.D., (Cantab.), F.L.S.

In the December number of *Tropical Agriculture* Vol. I, No. 12, on page 191, a statement occurs under the heading of "Report on Pineapples and Bananas in Jamaica" to the effect that the acreage under banana cultivation is four times greater than ever before. Owing to the pressure on our space the original note had to be considerably abbreviated and we regret to state that it was not made clear that this particular increase in cultivation referred only to the Trelawney district.

As a supplement to the April issue of the Journal we hope to publish an account of the Experimental Sugar Factory which will soon commence grinding operations. The supplement will give the history of the Factory, details of the College Course in Sugar Technology, and information concerning the machinery, together with the names of the donors, specially written by Professor O. F. Boyd, Head of the Department of Sugar Technology and will contain photographic prints of the Factory and the machinery in course of erection.

It is hoped that among other articles the April number will contain "Silani," by Professor Harland; the conclusion of Sir David Prain's article on "Botanic Gardens"; "Rhodesian Cattle Industry" by Dr. Eric Nobbs, late Director of Agriculture, Southern Rhodesia; "Forestry and Agriculture" by Mr. R. C. Marshall, Conservator of Forests, Trinidad and Tobago; "Tube Wells" by Dr. H. M. Leake, and "Forecasting the Cotton Crop in St. Vincent," by Mr. L. H. Burd, Cotton Research Assistant for St. Vincent.

Monday, January 19th, was a "red letter day" in the history of the Journal, more subscriptions being received on that one day than in any previous month with the exception of December. The increase in the number of subscribers to *Tropical Agriculture* during January has established a record which the College can hardly hope to excel. The numbers exceed those of any previous three consecutive months even including the previous record established in December. The number of subscribers is now 50 per cent. greater than on December 31st, 1924. The subscriptions received during December and January, together equal the number received during the previous eight months.

In response to many enquiries the Editor wishes to state that, for the present, in spite of the increase in the size of the Journal it is not intended to increase the subscription rate as it is the desire of the College authorities that no one should be prevented from becoming a reader on account of a prohibitive price.